A Theory of Economic Coercion and Fragmentation

Christopher Clayton* Matteo Maggiori† Jesse Schreger‡

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Abstract

Hegemonic powers, like the United States and China, exert influence on other countries by threatening the suspension or alteration of financial and trade relationships. We show that the mechanisms that generate gains from integration, such as external economies of scale and specialization, also increase these countries' power to exert economic influence because in equilibrium they make other relationships poor substitutes for those with a global hegemon. Smaller countries can insulate themselves from geoeconomic pressure from hegemons by pursuing anti-coercion policy: shaping their economies in ways that insulate it from undue foreign pressure. This policy faces a tradeoff between gains from trade and economic security. We show that while an individual country can make itself better off, uncoordinated attempts by multiple countries to limit their dependency on the hegemon lead to unwinding of the global gains from integration and inefficient fragmentation of the global financial and trade system. We study a leading application focusing on financial services as both tools of coercion by the hegemon and an industry with strong strategic complementarities at the global level. We provide estimates of geoeconomic power for the US and China and show empirically that the geoeconomic power of the United States relies strongly on financial services while that of China loads more on manufacturing trade.

Keywords: Geoeconomics, Geopolitics, Anti-Coercion Policy, Great Powers, Economic Security, Economic Statecraft, Global Value Chains, Payment Systems, International Role of the Dollar, Dollar Diplomacy.

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*Yale School of Management and NBER; christopher.clayton@yale.edu.

†Stanford University Graduate School of Business, NBER, and CEPR; maggiori@stanford.edu.

‡Columbia Business School, NBER, and CEPR; jesse.schreger@columbia.edu.

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1 Introduction

The emergence of China as a world power, the increased use of sanctions and economic coercion by the United States, and large technological shifts are leading governments around the world to re-evaluate their policies on economic security and global integration. Governments fear their economies becoming dependent on inputs, technologies, or financial services ultimately controlled by a hegemonic country, such as the US or China. They fear being pressured by these foreign powers into taking actions against their interest as a condition for continued access to these inputs. As a result, governments are pursuing anti-coercion policies in an attempt to insulate their economies from undue foreign influence. For example, the European Commission set forth a European Economic Security Strategy to counter the "risks of weaponisation of economic dependencies or economic coercion."[1]

In this paper, we show that traditional rationales for the gains from integration, such as economies of scale and specialization, can lead to interdependent global systems that become instruments of economic coercion. For example, consider global payments systems: a service with strong strategic complementarities since each entity wants to be part of a system the more everyone else is already part of it. It is a standard argument that a globally dominant system is efficient by coordinating all participants in one system and fully realizing the economies of scale. This efficiency gain also makes other alternative systems poor substitutes for the dominant one by being under-scaled. If a country effectively controls the dominant system, like the US does in practice, it can be a source of power over foreign firms and countries by threatening suspension of access. The targeted entities have on the margin only poor alternative payment systems.

Countries anticipate that hegemonic powers will seek to influence them using these strategic inputs and have incentives to build domestic alternatives. Each country faces a tradeoff between economic security and gains from integration. Unfortunately, uncoordinated pursuit of economic security, via subsidies on home alternatives or restrictions on the use of foreign inputs, fragments the global economy, destroying too much of the gains from trade and financial integration. We show that there is a "fragmentation doom loop": as each country breaks away from the globally integrated system, the system itself becomes less attractive to all other participants, increasing the incentives of other countries to also break away. The resulting fragmentation is inefficient as each country over-secures its own economy.

We build a model of the world economy with input-output linkages among productive sectors located in different countries. Crucially, we allow for both production externalities, such as external economies of scale and strategic complementarities in the usage of some inputs, and externalities on consumers, which allow us to capture geopolitical spillovers. The model has a Stackelberg timing. Ex-ante all countries, including the hegemon, pursue policies on their domestic sectors that shape

[1] See the June 2023 announcement and January 2024 proposals. Relatedly, see the G7 governments communique on Economic Resilience and Economic Security. Appendix A.1 reviews recent economic security policy initiatives.

production. Formally, these policies are revenue-neutral wedges in the firms' first order conditions for the production problem. These wedges capture industrial, financial, and trade policy. Our model features a hegemonic country that can, ex-post, use threats to stop or alter the provision of inputs to other entities to induce them to take costly actions as in Clayton, Maggiori and Schreger (2023). These actions take the form of monetary transfers to the hegemon, tariffs or quantity restrictions on trade of goods or services, and political concessions, and cover the most frequently used actions in geoeconomics in practice. Because the hegemon has no direct legislative control over foreign entities, the hegemon's power to induce these entities to agree to its demands is limited by a participation constraint, reflecting that the cost of compliance cannot exceed the cost of losing access to the hegemon's network. In practice secondary sanctions often put forward to targeted entities a stark choice: comply or stop doing business with the hegemon and its network. In each country, production takes place at the end subject to both the domestic government policy and any policy successfully imposed by the hegemon.

Our main analysis studies the interaction between the policies and threats of the hegemon and the ex-ante policies of the countries in the rest of the world. For example, a government could restrict its firms from purchasing the hegemon's goods, or could provide a subsidy on the use of a home (or foreign) alternative to the hegemon's goods. We assume that each government takes into account the equilibrium impact of its domestic policies not only through changes in the behavior of private agents, but also through the change in the threats and demands made by the hegemon. We refer to policies adopted by each government for the purpose of altering the hegemon's demands as anti-coercion policies.

There is a fundamental conflict between the objectives of the hegemon and foreign entities. The hegemon cares about its power, which arises from the gap between the foreign entities inside and outside option. At the inside option, the foreign entity accepts the hegemon's demands and produces undisturbed with access to all inputs. At the outside option, the foreign entity rejects the hegemon's demands, thus undertaking no costly actions, but loses access to the hegemon's controlled inputs. The hegemon, therefore, increases its power by either making the inside option better or the outside option worse. The foreign entity, instead, cares about the level of the value it retains in equilibrium. Formally, we show that the optimal contract of the hegemon leaves the foreign party's value equal to its outside option.

The hegemon uses its policies to build up its power and extract maximal surplus from the rest of the world. Intuitively, the hegemon seeks to make foreign economies dependent on its own inputs, a hegemon-centric globalization, so that threats of their withdrawal are most powerful. Formally, this means manipulating the world equilibrium, via production externalities and terms of trade, so that foreign entities find it privately more attractive to use the hegemon's input and costly to be excluded. Such a policy from the hegemon can include a demand that trading with the hegemon involves reducing the use of domestically produced alternative goods, or a subsidy to the hegemon producers to make their inputs cheap on world markets.

In contrast, the government of a foreign country, anticipating that the hegemon will attempt to influence its domestic firms, values increasing the outside options of its domestic firms if they refuse the hegemon's offer. This can lead a country towards protectionism or anti-coercion focused industrial policy because the anticipation of hegemonic influence leads countries to adopt policies that raise their firms' payoffs when they resist hegemonic influence.

Compared to a global planner, the hegemon pursues policies that aim to lower the rest of the worlds' outside options even when doing so destroys some inside option value. This is, of course, inefficient from a global welfare perspective. Yet, the hegemon is not purely predatory: all else equal, the hegemon pursues policies that increase the inside option by coordinating global production externalities. It does so to make its hegemony attractive to the rest of the world. We show that optimal anti-coercion policy pursued by foreign governments can result in global welfare destruction. Each country wants to insulate its economy, increasing its outside option, to improve its position vis a vis the hegemon. In doing so, each government ignores the spillover effects on other countries. In the presence of positive spillovers from integration, anti-coercion policy over-fragments the world economy.

We apply our general theory to study global financial services as a strategic geoeconomic sector. Financial services have become a major tool of either implicit or explicit coercion by the United States. Instances have included extensive financial sanction packages on Iran and Russia, pressure on HSBC to reveal business transactions related to Huawei and its top executives, as well as pressure on SWIFT to monitor potential terrorists' financial transactions. The US heavy use of financial services to pressure foreign governments and private companies arises from the dominance of the United States and the dollar-centric financial system. This dominance has started to increase incentives for some countries to pursue anti-coercion policy. For example, following an earlier sanctions package applied to Russia in 2014, Russia developed a domestic messaging system called SPFS (System for Transfer of Financial Messages) that potentially helped Russia to cushion the blow of having some of its banks disconnected from SWIFT in 2023. China has been developing and growing its own messaging and settlement system CIPS (Chinese Cross-Border Interbank Payment System) in an attempt to isolate itself from potential US coercion, but also as a means to offer an alternative to other countries that might fear US pressure. For now, these alternatives are inefficient substitutes, but highlight the incentives to build alternatives and fragment the system.

We consider an application of the model in which firms in a country can use both a domestic financial service and also a global one provided by the hegemon. A key characteristic of financial services is that they exhibit strong strategic complementarities in adoption. We capture gains from international integration by assuming that the hegemon's global financial services sector features an international strategic complementarity from adoption, whereas home alternatives can only be used by domestic firms and so only feature a local strategic complementarity. This set-up captures the notion of a globally efficient payment system and multiple home-alternative versions that are imperfect substitutes. We show that, in the absence of anti-coercion policy, the hegemon uses its power to induce foreign firms to shift away from their domestic alternative and towards the hegemon's global services. The hegemon thus coordinates global financial integration and induces firms to internalize the global strategic complementarity. At the same time, the hegemon excessively integrates the global payment system in order to reduce the attractiveness of alternative payment systems. This hyper-globalization maximizes the hegemon's power and increases the transfers or political concessions it can demand.

In this application, anti-coercion policies of foreign countries take the form of restrictions on the use of the hegemon's services and subsidies on the use of the home alternative. We provide a stark and illustrative result: each country finds it optimal to fully fragment from the hegemon, providing an efficient subsidy to the home alternative while also imposing maximal restrictions on the use of the hegemon's system. This leads to full international fragmentation, with each country relying exclusively on its home alternative to shield itself from foreign influence. We show that this fragmentation is Pareto inefficient: every country would have been better off in a non-cooperative equilibrium without hegemonic influence and without anti-coercion.

We then use our model to measure the sources of geoeconomic power around the world. We demonstrate that, when production is CES within each sector (as in our financial sector application) and Cobb-Douglas across sectors, the power of a hegemon over a sector can be measured with simple ex-ante sufficient statistics. In particular, the cost to a firm of losing access to a hegemon's input depends only on the expenditure share on a sector, the expenditure share within that sector on the hegemon's input, and the elasticity of substitution across varieties within a sector. We build this measure at the country level for the power of the United States and China and find that for plausible ranges of the elasticity of substitution of financial services produced by different countries the provision of financial services is the key source of American geoeconomic power. This contrasts sharply with China, where relatively little of China's growing geoeconomic power comes from financial services. While there is a large degree of uncertainty on what measures of financial service trade capture as well as the relevant elasticity of substitution for service trade, this section demonstrates that measures of the coercive powers of countries based only on goods trade are likely to dramatically underestimate the power of the United States. Thus providing empirical support for our focus on the coercive power of the global payments system and more broadly for the focus on the importance of international financial power for geoeconomic influence.

Literature Review. Our paper is related to the literature on geoeconomics in both economics and political science. The notion of economic statecraft and coercion was put forward by Hirschman (1945) in a landmark contribution and discussed in detail by Baldwin (1985). Kindleberger (1973), Gilpin (1981), and Keohane (1984) created "hegemonic stability theory" and debated whether hegemons, by providing public goods globally, can improve world outcomes. Keohane and Nye (1977) analyze the relationship between power and economic interdependence. Cohen (2015, 2018) focus specifically on the interplay between the monetary system and geopolitics. Blackwill and Harris (2016), Farrell and Newman (2019), and Drezner et al. (2021) explore economic coercion and "weaponized interdependence" whereby governments can use the increasingly complex global economic network to influence and coerce other entities. This paper is part of a rapidly growing literature in economics aiming to understand geoconomics and economic coercion including Clayton, Maggiori and Schreger (2023), Thoenig (2023), Becko and O'Connor (2024), Broner, Martin, Meyer and Trebesch (2024), Liu and Yang (2024), Kooi (2024), and Pflueger and Yared (2024). Liu and Yang (2024) develop a trade model with the potential for international disputes, construct a model-consistent measure of international power, and demonstrate that increases in power lead to more bilateral negotiations.

We also relate to the macroeconomics and trade literature that analyzed optimal industrial, trade, and capital control policies. From industrial policy Ottonello, Perez and Witheridge (2023), Liu (2019), Bartelme, Costinot, Donaldson and Rodriguez-Clare (2019), Juhász, Lane, Oehlsen and Pérez (2022), and Farhi and Tirole (2024).[2] From network resilience Acemoglu, Carvalho, Ozdaglar and Tahbaz-Salehi (2012), Bigio and La'O (2020), Baqaee and Farhi (2020, 2022), Elliott et al. (2022), Acemoglu and Tahbaz-Salehi (2023), Bai, Fernández-Villaverde, Li and Zanetti (2024). From trade and commercial policy Bagwell and Staiger (1999, 2001, 2004); Grossman and Helpman (1995); Ossa (2014), as well as the recent literature on optimal policy along value chains as in Grossman et al. (2023). From capital controls and terms of trade manipulation Farhi and Werning (2016), Costinot et al. (2014), Sturm (2022).

Our paper contributes to a growing empirical literature exploring the relationship between geopolitics and fragmentation of global trade and investment (Thoenig (2023), Fernández-Villaverde et al. (2024), Gopinath et al. (2024), Aiyar et al. (2024), Alfaro and Chor (2023), Hakobyan et al. (2023), Aiyar et al. (2023) and Crosignani et al. (2024)). Our paper contributes by deriving a structural gravity equation linking country and hegemon preferences that serves as a guide for this style of empirical work, as well as providing a structural interpretation to these regressions.

Finally, our application on the role of the international provision of financial services relates to a large literature on the changing nature of the international monetary system. Bahaj and Reis (2020) and Clayton et al. (2022) study China's attempt to internationalize its currency and bond market. Scott and Zachariadis (2014), and Cipriani et al. (2023) survey the role of SWIFT and the global payments systems in international sanctions. Bianchi and Sosa-Padilla (2024), Nigmatulina (2021), Keerati (2022), and Hausmann et al. (2024) study trade and financial sanctions on Russia in the wake of the 2014 and 2022 invasions of Ukraine.

2 Model Setup

There are N countries in the world. Each country n is populated by a representative consumer and a set of productive sectors $\mathcal{I}_n$, and is endowed with a set of local factors $\mathcal{F}_n$. We define $\mathcal{I}$ to

[2] Juhász, Lane and Rodrik (2023) surveys the recent literature on industrial policy.

be the union of all productive sectors across all countries, $\mathcal{I} = \bigcup_{n=1}^{N} \mathcal{I}_n$, and define $\mathcal{F}$ analogously. Each sector produces a differentiated good indexed by $i \in \mathcal{I}$ out of local factors and intermediate inputs produced by other sectors. Each sector is populated by a continuum of identical firms. The good produced by sector i is sold on world markets at price p_i. Local factor f has price p^ℓ_f. Local factors are internationally immobile. We take the good produced by sector 1 as the numeraire, so that $p_1 = 1$. We define the vector of all intermediate goods' prices as p, the vector of all local factor prices as p^ℓ, and the vector of all prices as $P = (p, p^\ell)$. The global input-output structure is analogous to Clayton et al. (2023).

Representative Consumer. The representative consumer in country n has preferences $U(C_n) + u_n(z)$, where $C_n = \{C_{ni}\}_{i\in\mathcal{I}}$ and where z is a vector of aggregate variables which we use to capture externalities à la Greenwald and Stiglitz (1986). We simplify the analysis by assuming that the consumption utility function U is homothetic and identical across countries and.[3] We also assume U is increasing, concave, and continuously differentiable. Individual consumers take z as given. The representative consumer in each country owns all domestic firms and the endowments of local factors. The representative consumer of country n faces a budget constraint given by:

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

where Π_i are the profits of sector i and $p^\ell_f \bar{\ell}_f$ is the compensation earned by the local factor of production f. We denote the consumer's Marshallian demand function $C(p, w_n)$, where $w_n = \sum_{i\in\mathcal{I}_n} \Pi_i + \sum_{f\in\mathcal{F}_n} p^\ell_f \bar{\ell}_f$, and her indirect utility function from consumption as $W(p, w_n) = U(C(p, w_n))$. The consumer's total indirect utility is $W(p, w_n) + u_n(z)$.

Firms. A firm in sector i located in country n produces output y_i using a subset $\mathcal{J}_i$ of intermediate inputs and the set of local factors of country n, $\mathcal{F}_n$. Firm i's production function is $y_i = f_i(x_i, \ell_i, z)$, where $x_i = \{x_{ij}\}_{j\in\mathcal{J}_i}$ is the vector of intermediate inputs used by firm i, x_{ij} is the use of intermediate input j, $\ell_i = \{\ell_{if}\}_{f\in\mathcal{F}_n}$ is the vector of factors used by firm i, and ℓ_{if} is the use of local factor f. Firms take the aggregate vector z as given. We further assume that f_i is increasing, strictly concave, satisfies the Inada conditions in (x_i, ℓ_i), and is continuously differentiable in (x_i, ℓ_i, z).[4] The sector-specific production function f_i allows us to capture technology, but also transport costs, and relationship-specific knowledge. Firms in this model are best thought of as entities that perform an economic activity, which encompasses manufacturing, but also wholesalers and financial intermediaries. They also do not have to be solely private entities, many could be owned and operated

[3] This implies that the optimal composition of consumption out of one unit of wealth is identical across countries' consumers, and therefore wealth transfers among consumers do not induce relative price changes in goods. This simplifies our analysis at small costs to the economics of the model.

[4] We also allow for the existence of sectors that repackage factors but use no intermediate inputs, that do not necessarily satisfy Inada conditions on factors.

by governments (e.g., a state-owned enterprise).

Central to our analysis is the possibility that a firm is cut off from being able to use some inputs. We define the firm's profit function, if it were restricted to produce using only a subset $\mathcal{J}_i' \subset \mathcal{J}_i$ of intermediate goods, as

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

which leaves implicit that $x_{ij} = 0$ for $j \notin \mathcal{J}_i'$. The firm's decision problem, given inputs $\mathcal{J}_i'$ available, is to choose its inputs and factors (x_i, ℓ_i) to maximize its profits $\Pi_i(x_i, \ell_i, \mathcal{J}_i')$.

Market Clearing and Externalities. Market clearing for good j and factor f in country n are given by

$$\sum_{n=1}^{N} C_{nj} + \sum_{i \in \mathcal{I}} x_{ij} = y_j, \qquad \sum_{i \in \mathcal{I}_n} \ell_{if} = \bar{\ell}_f$$

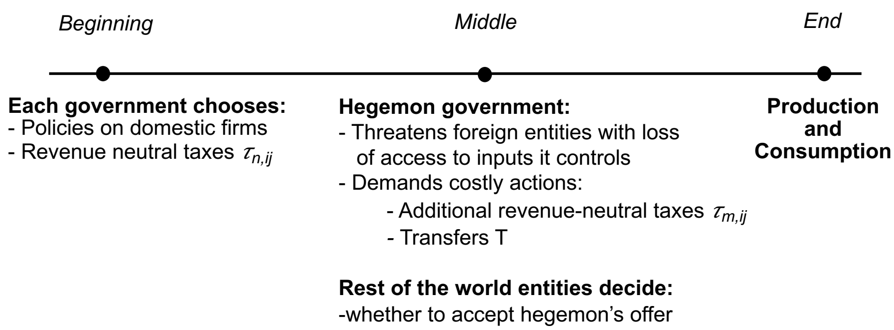
which uses again that $x_{ij} = 0$ if $j \notin \mathcal{J}_i$. We assume that the vector of aggregates takes the form $z = \{z_{ij}\}$. In equilibrium $z_{ij}^* = x_{ij}^*$, where we use the $*$ notation to stress it is an equilibrium value. That is externalities are based on the quantities of inputs in bilateral sectors i and j relationships. This general formulation can be specialized to cover pure external economies of scale, in which it is the total output of a sector that matters, or strategic complementarities in the usage of an input, in which it is the extent to which an input is widely used across sectors that matters.

2.1 Hegemon, Target Countries, and Geoeconomic Policies

Each country n has a government that sets policy on its domestic sectors. One country, denoted m, is a world hegemon that can also seek to impose policies on foreign sectors. Since the hegemon lacks legal jurisdiction over foreign entities, the hegemon instead uses threats to exclude a foreign entity from buying a subset of inputs if that entity does not comply with the hegemon's demands. The model has a Stackelberg timing with the timeline presented in Figure 1. First, all countries (including the hegemon) simultaneously choose policies for their domestic sectors. Then, the hegemon makes take-it-or-leave-it offers to foreign entities. We focus here on the hegemon pressuring foreign firms and Appendix A.3.1 extends our analysis to allow the hegemon to pressure other governments directly.

Each country's government has policy instruments that consist of a complete set of revenue-neutral wedges $\tau_{n,i} = \{\{\tau_{n,ij}\}_{j \in \mathcal{J}_i}, \{\tau_{n,if}^\ell\}_{f \in \mathcal{F}_n}\}$ for each domestic firm $i \in \mathcal{I}_n$, where $\tau_{n,ij}$ is the bilateral wedge (tax) on purchases by firm i of good j and $\tau_{n,if}^\ell$ is the bilateral factor wedge. The first subscript n identifies the country imposing the tax, the second subscript i the firm subject to the tax, and the third subscript j the sourcing relationship that is being taxed. The equilibrium revenues of the tax are remitted lump-sum to the sector they are collected from, and are adapted

Figure 1: **Timeline**



Notes: Model timeline.

to whether or not the firm accepts the hegemon's contract. Country n takes both the taxes and revenue remissions of other countries as given.[5]

Revenue-neutral wedges can be used to capture Pigouvian taxes and quantity restrictions (e.g., Clayton and Schaab (2022)) and are common in the macroprudential policy literature (Farhi and Werning (2016)). Such instruments capture many policies that governments pursue on their domestic firms such as industrial policy and trade policy (e.g., export or import controls and tariffs). In this paper we refer to them as wedges, since their function is to impose a wedge in the first order condition of the targeted entity in order to induce a change in behavior. Governments have the legal powers to impose these policies on their domestic firms and do so for both domestic and international policy objectives. Our focus is on how governments in each country use the wedges to pursue anti-coercion policy: for example, encouraging domestic firms to scale up production of alternatives to the inputs controlled by the hegemon.[6] The hegemon country, which we describe next, also uses these wedges to bolster its international power: for example, subsidizing a strategic industry such as finance or semiconductors for which there is no availability of close substitutes in foreign countries.

2.2 Hegemon Problem

After domestic policies are set by all governments, the hegemon country's government m can make take-it-or-leave-it offers to entities in other countries that require them to take costly actions. The hegemon induces these changes in targeted entities' behavior by threatening to cut off the supply

[5] Although off-path a country n policy change can thus lead to nonzero net revenues collected by a foreign government from its domestic sectors, such net revenues are a wash since both revenues and profits ultimately accrue to that country's consumer.

[6] Another potential tool that governments other than the hegemon could adopt would be a transfer-based anti-coercion tool: promised monetary transfer $G_i \geq 0$ to firm i if that firm rejects the hegemon's contract. It is an anti-coercion tool in the sense that, all else equal, it reduces the feasible set of costly actions that the hegemon can demand of firm i. It is straight-forward to extend the framework to include such subsidies.

of the inputs it controls to entities that reject its demands.

We assume that the hegemon can contract with every foreign firm that sources at least one input from the hegemon's domestic firms. Formally, this set of firms is $\mathcal{C}_m = \{i \in \mathcal{I} \backslash \mathcal{I}_m \mid \mathcal{J}_i \cap \mathcal{I}_m \neq \emptyset\}$. Hegemon m's offer to firm $i \in \mathcal{C}_m$ has three components: (i) a non-negative transfer T_i from firm i to the hegemon's representative consumer; (ii) revenue-neutral wedges $\tau_{m,i} = \{\{\tau_{m,ij}\}_{j \in \mathcal{J}_i}, \{\tau^{\ell}_{m,if}\}_{f \in \mathcal{F}_n}\}$ on purchases of inputs and factors, with equilibrium revenues $\tau_{m,ij} x^*_{ij}$ and $\tau^{\ell}_{m,if} \ell^*_{if}$ raised from sector i rebated lump sum to firms in sector i that accept the contract; (iii) a *punishment* $\mathcal{J}^o_i$, that is a restriction to only use inputs $j \in \mathcal{J}^o_i$ if firm i rejects the hegemon's contract. We denote $\Gamma_i = \{T_i, \tau_{m,i}, \mathcal{J}^o_i\}$ the contract terms offered to firm $i \in \mathcal{C}_m$, which reflects that a firm accepting the contract accepts the costly actions $(T_i, \tau_{m,i})$ and avoids the punishment $\mathcal{J}^o_i$. The hegemon's offer is made to each individual firm within a sector, meaning one atomistic firm could reject the offer while all other firms in the same sector accept it.[7]

We restrict the punishments that the hegemon can make to involve sectors that are at most one step removed from the hegemon, that is involving either the hegemon's sectors or the foreign firms that the hegemon contracts with. This avoids unrealistic situations in which the punishment of the hegemon occurs over arbitrary long supply chains of foreign entities. Formally, a punishment $\mathcal{J}^o_i$ is *feasible* if $\mathcal{J}_i \backslash (\mathcal{I}_m \cup \mathcal{C}_m) \subset \mathcal{J}^o_i$. We define $\underline{\mathcal{J}}^o_i = \mathcal{J}_i \backslash (\mathcal{I}_m \cup \mathcal{C}_m)$ to be the maximal punishment that the hegemon can threaten: i.e. suspending access to all inputs that it controls either directly, via its own firms, or indirectly, via the immediate downstream firms of its own firms.

In our model what makes the hegemon government special is the ability to coordinate threats using its economic network. The hegemon is seeking to pressure entities over which it has no direct legal power to impose policies. We draw a stark distinction between the ability that each government has to dictate some actions (wedges) to their domestic entities and the hegemon pressuring foreign entities to voluntarily comply with its request. This naturally makes the foreign entities' participation constraints a crucial element of the theory.

Participation Constraint. Firm $i \in \mathcal{C}_m$ chooses whether or not to accept the take-it-or-leave-it offer made by the hegemon. Firm i, being small, does not internalize the effect of its decision to accept or reject the contract on the prevailing aggregate vector z and prices P .

If firm i rejects the hegemon's contract, it does not have to comply with the hegemon's demands but is punished by losing access to the inputs controlled by the hegemon. If firm i rejects the contract Γ_i, it achieves value $V^o_i(\mathcal{J}^o_i)$ where:

$$V^o_i(\mathcal{J}^o_i) = \max_{x_i, \ell_i} \; \Pi_i(x_i, \ell_i, \mathcal{J}^o_i) - \sum_{j \in \mathcal{J}_i} \tau_{n,ij}(x_{ij} - x^o_{ij}) - \sum_{f \in \mathcal{F}_m} \tau^{\ell}_{n,if}(\ell_{if} - \ell^o_{if}). \tag{1}$$

We use the superscript $\circ$ to denote values of objects at the outside option. For example, (x^o_i, ℓ^o_i) are

[7] In principle we could also allow the hegemon to also contract with its domestic firms. Because the hegemon already has a complete set of wedges for domestic firms ex ante, in equilibrium the hegemon would not want to change its policies applied to domestic firms.

the equilibrium optimal allocations of a firm in sector i conditional on it rejecting the hegemon's contract. If instead firm i accepts the contract Γ_i, it achieves value $V_i(\Gamma_i) = V_i(\tau_{m,i}, \mathcal{J}_i) - T_i$, where

$$V_i(\tau_{m,i}, \mathcal{J}_i) = \max_{x_i, \ell_i} \Pi_i(x_i, \ell_i, \mathcal{J}_i) - \sum_{j \in \mathcal{J}_i} (\tau_{m,ij} + \tau_{n,ij})(x_{ij} - x^*_{ij}) - \sum_{f \in \mathcal{F}_m} (\tau^\ell_{m,ij} + \tau^\ell_{n,ij})(\ell_{if} - \ell^*_{if}), \quad (2)$$

which implicitly defines the optimal allocations (x^*_i, ℓ^*_i) as a function of the contract offered.[8]

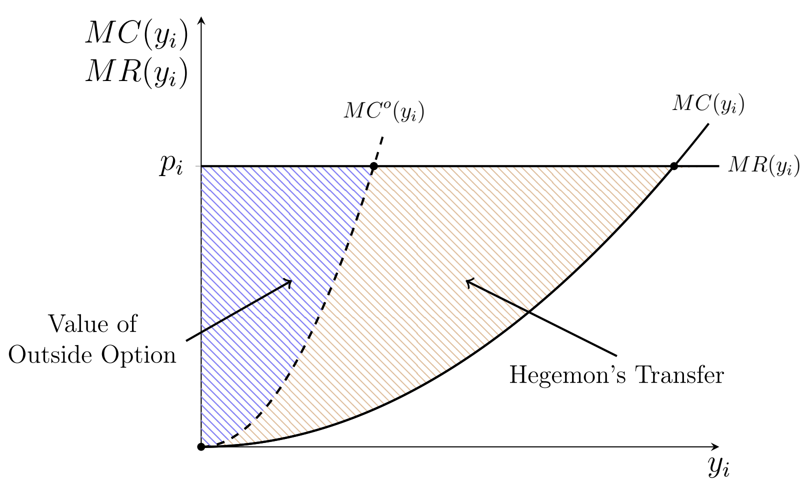
Firm i accepts the contract if it is better off by doing so, giving rise to the participation constraint

$$V_i(\tau_m, \mathcal{J}_i) - T_i \geq V^o_i(\mathcal{J}^o_i). \quad (3)$$

Slackness in this constraint when the hegemon demands no costly actions is achieved by a punishment that decreases the outside option, the right hand side. This slackness is the source of the hegemon power since it makes it possible for the hegemon to successfully induce foreign entities to take the costly actions it desires. The participation constraint traces the limits of hegemonic power since it sets the total private cost to the target firm of the actions that the hegemon can demand.

From this perspective, strategic sectors for the hegemon are those that would cause the largest losses for targeted entities were they to be cut off. As we revisit in Section 5, those tend to be inputs (to foreign firms) that have a low elasticity of substitution and that cannot easily be sourced elsewhere. Typical examples are advanced semiconductors or the services of the dollar-based payment system. As we show in the rest of the paper, however, the expected use of these sectors by the hegemon to coerce foreign entities can backfire by inducing foreign governments ex-ante to create alternatives and reduce dependence on the hegemon.

Figure 2: **Hegemon's Power Building Motives**



[8]Recall that the hegemon takes the portion $r^*_{n,i} = \sum_{j \in \mathcal{J}_i} \tau_{n,ij} x^*_{ij} + \sum_{f \in \mathcal{F}_n} \tau^\ell_{n,ij} \ell^*_{if}$ of revenue remissions as given.

Hegemon Maximization Problem. The hegemon's government objective function is the utility of its representative consumer to whom all domestic firm profits and all transfers accrue. Wedges on all sectors are revenue neutral for the hegemon and, therefore, net out. However, transfers from foreign sectors do not net out because the hegemon's consumer has no claim to foreign sectors' profits. The hegemon objective function is then:

$$\mathcal{U}_m = W(p, w_m) + u_m(z), \quad w_m = \sum_{i \in \mathcal{I}_m} \Pi_i(\Gamma_i) + \sum_{f \in \mathcal{F}_m} p_f^\ell \bar{\ell}_f + \sum_{i \in \mathcal{C}_m} T_i. \tag{4}$$

The hegemon chooses contract terms Γ to maximize its utility, subject to firms' participation constraints (equation 3), feasibility of punishments, and non-negativity of transfers $T \geq 0$.[9]

Our model allows for a sharp characterization of the off-path punishments that the hegemon threatens. Intuitively, the hegemon always imposes the maximum punishment possible for rejecting its contract because any costly actions that a firm would comply with under a weaker punishment, that firm would also comply with under the maximal punishment. We formalize this result in the lemma below.

Lemma 1 *It is weakly optimal for the hegemon to offer a contract with maximal punishments to every firm it contracts with, that is $\mathcal{J}_i^o = \underline{\mathcal{J}}_i^o$ for all $i \in \mathcal{C}_m$.*

Hegemon's Power Building Motives. We solve the hegemon's problem in two steps: we first characterize how the hegemon sets the transfers T_i and then we characterize the hegemon's optimal wedges. Although the ability to demand a transfer T_i suggests that every participation constraint should bind, the result is not immediate because there is a trade-off between transfers and costly actions. We prove the following result.

Lemma 2 *Under the hegemon's optimal contract, the participation constraint binds for each firm $i \in \mathcal{C}_m$, that is $T_i = V_i(\tau_m, \mathcal{J}_i) - V_i^o(\underline{\mathcal{J}}_i^o)$.*

Figure 3 provides a visual representation of Lemma 2. For a specific sector i in country n, it plots the marginal cost (MC) and marginal revenue (MR) curves of producing output y_i. The marginal revenue curve is constant at p_i for an individual atomistic firm in sector i, and the marginal cost curve is increasing in y_i given decreasing returns to scale. Total firm profits Π_i at the inside option are the area between the $MR(y_i)$ and $MC(y_i)$ curves. At the outside option, the firm marginal cost curve shifts to the left to MC^o, reflecting the higher marginal cost of production arising from only being able to access a subset of inputs. The Lemma above shows that the hegemon extracts the difference between the inside option and the outside option (the red shaded area) as a side payment. The hegemon, therefore, cares about increasing this *gap* by either increasing the target firm's inside

[9] In this setup, we have not allowed the hegemon to ask firms (either its own or those it contracts with) to impose bilateral export tariffs on sales to these foreign firms, with infinite tariffs imitating a punishment severing the relationship. It is straightforward to extend the model to allow for such instruments.

option or by decreasing its outside option. In contrast, the firm retains only the portion of its profits arising from its outside option (the blue shaded area) and cares about the *level* of these profits.[10]

Having characterized how the hegemon sets transfers, the proposition below characterizes the optimal wedges $\tau_{m,ij}$ that the hegemon demands of foreign firms $i \in \mathcal{C}_m$ (with factor wedges characterized in the proof). Since by Lemma 2 the participation constraints bind, we substitute it into the hegemon's problem and keep track of the Lagrange multiplier η_i on the transfers non-negativity constraint: $T_i = V_i(\tau_m, \mathcal{J}_i) - V_i^o(\underline{\mathcal{J}}_i^o) \geq 0 \quad \Rightarrow \quad V_i(\tau_m, \mathcal{J}_i) \geq V_i^o(\underline{\mathcal{J}}_i^o)$.

Proposition 1 *Under an optimal contract, the hegemon imposes on a foreign firm $i \in \mathcal{C}_m$, a wedge on input j given by*

$$\tau_{m,ij} = -\frac{1}{1+\frac{\partial W_m}{\partial w_m}\eta_i} \overbrace{\sum_{k\in\mathcal{C}_m}\left(1+\frac{1}{\frac{\partial W_m}{\partial w_m}}\eta_k\right)\left[\left(\frac{\partial \Pi_k}{\partial z} - \frac{\partial \Pi_k^o}{\partial z}\right)\frac{dz}{dx_{ij}} + \left(\frac{\partial \Pi_k}{\partial P} - \frac{\partial \Pi_k^o}{\partial P}\right)\frac{dP}{dx_{ij}}\right]}^{\text{Building Power}} +$$
$$-\frac{1}{1+\frac{1}{\frac{\partial W_m}{\partial w_m}}\eta_i}\left[\underbrace{\sum_{k\in\mathcal{I}} X_{m,k}\frac{\partial p_k}{\partial P}\frac{dP}{dx_{ij}}}_{\text{Terms-of-Trade}} + \underbrace{\left[\sum_{k\in\mathcal{I}_m}\frac{\partial \Pi_k}{\partial z} + \frac{1}{\frac{\partial W_m}{\partial w_m}}\frac{\partial u_m}{\partial z}\right]\frac{dz}{dx_{ij}}}_{\text{Domestic } z\text{-Externalities}} + \underbrace{\sum_{k\in\mathcal{I}_m}\tau_{m,k}\frac{d\boldsymbol{x}_k}{dx_{ij}}}_{\text{Private Distortion}}\right] \quad (5)$$

where $\boldsymbol{x}_i = (x_i, \ell_i)$, $\frac{d\boldsymbol{x}_i}{dx_{ij}} = \frac{\partial \boldsymbol{x}_i}{\partial z}\frac{dz}{dx_{ij}} + \frac{\partial \boldsymbol{x}_i}{\partial P}\frac{dP}{dx_{ij}}$, and where $X_{m,i}$ is exports of good i by the hegemon's country.

The optimal wedge trades off the marginal benefit and cost of reducing activity in the i, j economic link. The total (wealth-equivalent) marginal cost is $1 + \frac{1}{\frac{\partial W_m}{\partial w_m}}\eta_i$. This captures the direct cost of losing transfers from tightening the participation constraint, valued at 1 on the margin, and also the wealth-equivalent shadow cost of tightening the transfer nonnegativity constraint, $\frac{1}{\frac{\partial W_m}{\partial w_m}}\eta_i$. The Lagrange multiplier η_i tracks the marginal value to the hegemon of increasing its power over sector i in excess of simply being able to extract an extra transfer.

The marginal benefit grouped under the label "Building Power" tracks how changes in equilibrium prices ($\frac{dP}{dx_{ij}}$) and quantities ($\frac{dz}{dx_{ij}}$) change how much power the hegemon has over foreign entities. The hegemon has more power if the induced equilibrium change *raises* a firm's inside option ($\partial \Pi_k > 0$) or *lowers* its outside option ($-\partial \Pi_k^o > 0$). Intuitively, as in Figure 2, the hegemon is using the wedges to manipulate the equilibrium to maximize the gap between the inside and outside options of foreign entities. The hegemon is seeking to increase how dependent foreign economies are on the inputs it controls. It this sense, the hegemon wants to induce a globalization of the world economy that is centered on its own economy.

[10] In Appendix A.3.2, we extend our analysis to allow a split of surplus between the hegemon and the targeted entity, rather than all surplus going to the hegemon. The participation constraint becomes $V_i(\tau_m, \mathcal{J}_i) - T_i \geq \mu V_i^o(\mathcal{J}_i^o) + (1-\mu)V_i(\mathcal{J}_i)$, where μ reflects the bargaining position. Another interpretation of $1-\mu$ is as the probability that the firm is able to evade the punishment, for example by routing goods through third party countries. Although the firm now values a combination of its inside and outside options, the core insight remains that the hegemon and the firm have conflicting objectives (level of profits vs difference between inside and outside option profits).

The marginal benefits in the second line of equation 5 are more conventional optimal policy terms. The firm term, "Terms-of-Trade," reflects the hegemon's motive to manipulate its terms of trade with foreign countries: boosting prices of goods it exports ($X_{m,k} > 0$) and lowering prices of goods it imports ($X_{m,k} < 0$). The second term, "Domestic z-externalities," reflects spillovers to the hegemon's domestic firms and consumers from changes in aggregate quantities. For example, the hegemon wants to lower the competitiveness of foreign industries that compete with its domestic ones. The third term, "private distortion," reflects the interaction between the induced equilibrium changes and domestic wedges that the hegemon places on its own firms in the ex-ante stage. If those wedges are zero, $\tau_{m,k} = 0$, this effect is zero by Envelope Theorem. Otherwise, the hegemon accounts for its domestic firms' losses in private profits according to the magnitude of the distortion, $\tau_{m,k}$.

Leading Simplified Environments. To build intuition for our model it is at times useful to simplify the modeling environment by shutting off several channels. We consider two classes of simplifications: (i) a "constant prices" environment in which we switch off terms-of-trade manipulation incentives, and (ii) a "no z-externalities" environment in which we switch off the dependency of utility functions and production functions on the aggregates vector z. We briefly define each environment below. Our main results do not use these simplified environments.

Definition 1 *The* ***constant prices*** *environment assumes that consumers have linear preferences over goods,* $U = \sum_{i \in \mathcal{I}} \tilde{p}_i C_{ni}$*, and that each country has a local-factor-only firm with linear production* $f_i(\ell_i) = \sum_{f \in \mathcal{F}_n} \frac{1}{\tilde{p}_i} \tilde{p}^\ell_f \ell_{if}$*. We assume consumers are marginal in every good and factor-only firms are marginal in every local factor so that* $p_i = \tilde{p}_i$ *and* $p^\ell_f = \tilde{p}^\ell_f$*.*[11]

Definition 2 *The* ***no z-externalities*** *environment assumes that* $u_n(z)$ *and* $f_i(x_i, \ell_i, z)$ *are constant in* z*.*

3 Anti-Coercion Policy, Fragmentation, and Welfare

Moving backward in the timeline of Figure 1, at the beginning of the model the government of each country n chooses policies (sets wedges) applied to its own domestic firms internalizing how the hegemon's offered contract will change in response, but taking as given the policies adopted by all other countries. While each country n has a number of incentives for imposing wedges (e.g., domestic externality correction), we think of anti-coercion policy as the component targeted at influencing the hegemon's contract. At the end of this section, we also characterize the optimal wedges set by the hegemon on its own firms in this ex-ante stage, again isolating the component aimed at build up its hegemonic power.

[11] For example, we can guarantee this by assuming consumers and the factor-only firms can short goods and factors.

The government of country n chooses wedges τ_n in order to maximize its representative consumer's utility. Using Lemma 2, the objective of country n is

$$\mathcal{U}_n = W_n(p, w_n) + u_n(z), \qquad w_n = \sum_{i \in \mathcal{I}_n} V_i^o(\underline{\mathcal{J}}_i^o) + \sum_{f \in \mathcal{F}_n} p_f^\ell \bar{\ell}_f. \tag{6}$$

For sectors in country n that contract with the hegemon, the country n's government internalizes that they will be kept at their outside option ex-post (as in Figure 2) and, therefore maximizes the outside option value V_i^o. For all other sectors, instead, country n's government maximizes the inside option value V_i. For notational simplicity, we leave implicit the dependency of the hegemon's contract and equilibrium objects on anti-coercion policies, and for sectors that the hegemon does not contract with we define all outside option values to equal the inside option values (i.e., as if these firms were offered a trivial contract with no threats, no transfers, and no wedges). For these sectors, therefore, $V_i(\mathcal{J}_i) = V_i^o(\underline{\mathcal{J}}_i^o)$, leading to simpler notation in the equation above.

Network Propagation and Anti-Coercion. Our economy has an input-output structure similar to Clayton et al. (2023) in which amplification occurs via prices and z-externalities. In this paper, an additional crucial source of endogenous response is how the hegemon adapts its contract to changes in ex-ante policy, that is the anti-coercion measures.

Consider the second stage of the Stackelberg game, in which the hegemon takes as given all wedges set in the first stage and chooses its contract. This choice of hegemon wedges τ_m results in equilibrium aggregates (P, z^*). We characterize below the effect of an exogenous perturbation in an arbitrary constant e on these aggregates in the ex-post period of the Stackelberg game.

Proposition 2 *The aggregate response of z^* and P to a perturbation in an arbitrary constant e is*

$$\frac{dz^*}{de} = \Psi^z \left(\frac{\partial x}{\partial e} + \frac{\partial x}{\partial P} \frac{dP}{de} \right) + \Psi^z \frac{\partial x}{\partial \tau_m} \frac{d\tau_m}{de} \tag{7}$$

$$\frac{dP}{de} = \Psi^P \left(\frac{\partial ED}{\partial e} + \frac{\partial ED}{\partial z^*} \Psi^z \frac{\partial x}{\partial e} \right) + \Psi^P \left(\frac{\partial ED}{\partial \tau_m} + \frac{\partial ED}{\partial z^*} \Psi^z \frac{\partial x}{\partial \tau_m} \right) \frac{d\tau_m}{de} \tag{8}$$

where $\Psi^z = \left(\mathbb{I} - \frac{\partial x}{\partial z^*} \right)^{-1}$, where $\Psi^P = -\left(\frac{\partial ED}{\partial P} + \frac{\partial ED}{\partial z^*} \Psi^z \frac{\partial x}{\partial P} \right)^{-1}$, and where ED is the vector of excess demand in goods and factor markets.

To build intuition, consider the constant prices environment of Definition 1 so that there is no price amplification. Equation (7) reduces to

$$\frac{dz^*}{de} = \Psi^z \frac{\partial x}{\partial e} + \Psi^z \frac{\partial x}{\partial \tau_m} \frac{d\tau_m}{de}.$$

The first term on the right-hand side starts from the partial equilibrium demand response $\frac{\partial x}{\partial e}$ of all firms to the exogenous perturbation e, which is also the partial equilibrium response of z^* since

$z^* = x^*$ in equilibrium. The partial equilibrium effect is amplified when production externalities cause other firms to change their demand for inputs as well. This further shifts the equilibrium aggregate z^*, eliciting further demand changes, and so forth. The matrix Ψ^z is the fixed point of this feedback loop, with $\Psi^z \frac{\partial x}{\partial e}$ being the total change in all aggregates in equilibrium induced by the initial direct response to e. Ψ^z is akin to a Leontief inverse, but operating through externalities rather than prices.

The second term on the right-hand side captures changes in equilibrium aggregates as a consequence of how the hegemon changes its optimal contract. In response to the perturbation e, the hegemon adopts a total change $\frac{d\tau_m}{de}$ in the wedges that it imposes on foreign firms.[12]. These changes in the hegemon's wedges in turn elicit partial equilibrium demand responses from firms, $\frac{\partial x}{\partial \tau_m}$, that then filter through the Leontief amplification Ψ^z. We show next that this response of the hegemon and its equilibrium consequences are precisely what anti-coercion policy of each country seeks to influence.

When prices are not constant, amplification in equation (7) also occurs as a result of changes in prices inducing changes in firms' demand. Parallel in equation (8), price amplification occurs both because of direct changes in demand by firms and consumers, indirect changes in demand induced by z-externalities, and indirect changes in demand due to changes in the hegemon's contract.

3.1 Optimal Anti-Coercion Policy

We are now ready to characterize the optimal policy of country n – the wedges its government imposes on its domestic sectors – in the ex-ante stage in seeking to shield the economy from undue influence by the hegemon ex-post.[13]

Proposition 3 *The optimal wedges imposed by country n's government on its domestic sectors satisfy:*

$$\tau_n \frac{d\boldsymbol{x}_n^o}{d\tau_n} = -\left[\sum_{i \in \mathcal{I}_n} \frac{\partial \Pi_i^o}{\partial z} + \frac{1}{\frac{\partial W_n}{\partial w_n}} \frac{\partial u_n}{\partial z} \right] \frac{dz}{d\tau_n} - X_n^o \frac{dP}{d\tau_n} \tag{9}$$

where X_n^o is the vector of country n exports of goods $i \in \mathcal{I}$ and factors $f \in \mathcal{F}_n$ if firms were to operate at their outside option.

Proposition 3 presents the optimal wedge formula of country n, which balances the marginal cost on the left hand side with the marginal benefit on the right hand side. The direct marginal cost of a change in wedges is given by the amount that production is already distorted from the private optimum, τ_n, times the additional private distortion in production at the outside option from a perturbation in the wedge, $\frac{d\mathbf{x}_n^o}{d\tau_n}$. The right-hand side of the formula is the social benefit to country

[12]The hegemon also changes its demanded transfers, but these do not affect the equilibrium since the consumers have identical homothetic preferences.

[13]Proposition 3 provides necessary conditions for optimality.

n of the changes in equilibrium quantities z and prices P induced by the change in taxes. To illustrate the economics of each term, we turn to our simplified environments.

To illustrate the effect on quantities, we specialize the theory by assuming constant prices as in the environment of Definition 1. Then equation (3) reduces to

$$\tau_n \frac{d\mathbf{x}_n^o}{d\tau_n} = -\Bigg[\underbrace{\sum_{i \in \mathcal{I}_n} \frac{\partial \Pi_i^o}{\partial z} + \frac{1}{\frac{\partial W_n}{\partial w_n}} \frac{\partial u_n}{\partial z}}_{\text{Marginal Value of Change in Quantities}} \Bigg] \Bigg[\underbrace{\Psi^z \frac{\partial x}{\partial \tau_n}}_{\text{Standard Intervention}} + \underbrace{\Psi^z \frac{\partial x}{\partial \tau_m} \frac{d\tau_m}{d\tau_n}}_{\text{Anti-Coercion}} \Bigg], \tag{10}$$

where we substituted in from Proposition 2 $\frac{dz^*}{d\tau_n} = \Psi^z \frac{\partial x}{\partial \tau_n} + \Psi^z \frac{\partial x}{\partial \tau_m} \frac{d\tau_m}{d\tau_n}$. The first term reflects the social benefit of inducing changes in firm activities that result in equilibrium changes in the vector of aggregate quantities z. The marginal value of a change in quantities includes both the spillover to firm's profits at outside options (Π°) and to consumer utility (u_n). Country n wants to manipulate z-externalities to bolster its firms' outside options or benefit its consumers. For example, country n might push its own firms to scale up domestic production in industries with economies of scale and at the same time discourage use of inputs that the hegemon controls. This force features prominently in our application in Section 4.

The shift in equilibrium quantities in equation 10 has two components: the firm term, labeled "Standard Intervention", reflects endogenous input-output amplification from the propagation of externalities. This term would be there even in the absence of a hegemon since it reflects country n's government's motive to use wedges to correct externalities within its domestic economy. However, in the absence of a hegemon country n's government would impose the wedges to maximize the inside option value. In the presence of a hegemon, instead, it maximizes the outside option value to limit the transfers that the hegemon can extract.

The second term reflects the pure anti-coercion motive: country n's government imposes ex-ante wedges to shape its economy in a way that will shield it from ex-post influence by the hegemon. Formally, country n government internalizes how its ex-ante wedges will limit the ability of the hegemon to ex-post impose wedges on the domestic firm that decrease country n welfare.

To illustrate the effect via equilibrium prices, we specialize the general theory by assuming no z-externalities as in the environment of Definition 2. Then equation (3) reduces to:

$$\tau_n \frac{d\mathbf{x}_n^o}{d\tau_n} = \underbrace{-X_n^o \frac{dP}{d\tau_n}}_{\text{Terms of Trade Manipulation}} \tag{11}$$

The government of country n is now imposing wedges on its firms to manipulate the terms of trade. From Proposition 8 the term $\frac{dP}{d\tau_n}$ includes both standard price-based amplification and anti-coercion motives. The anti-coercion motive arises from the desire to limit the ability of the hegemon to ex-post manipulate the terms of trade against country n.

Proposition 3 and our discussions of the simplified environments above reveal the importance of network amplification for anti-coercion policy. In the absence of amplification, e.g. if there are constant prices (Definition 1) and no z-externalities (Definition 2), then country n's optimal policy is to impose no wedges $\tau_n = 0$. Intuitively, even though the hegemon is extracting the difference between the inside and outside options as a transfer payment, country n can no longer shift the equilibrium to improve its outside option. As a result, anti-coercion policies could lower the transfer extracted by the hegemon, but in the process would also lower the outside option of firms in country n, making both worse off.

The optimal policy characterized in this paper gives theoretical foundations for the Economic Security policies that many countries, e.g. the European Union, are introducing. It clarifies the rationale for government intervention, defines the scope and tool to be used, and warns about the danger that (globally) such policies might be counter productive. We turn to each of these elements next.

The rationale for country n's government intervention is that economic coercion is exerted, as often is in practice, by a hegemonic government on entities that do not internalize the entire equilibrium. A European firm accepting a technology sale to China, or a European bank acquiescing to US demands to stop dealing with a specific entity, do not internalize that these requests are being made at a system level and might change the entire macro dynamic. These firms simply comply because the private cost of not doing so would exceed their private benefit.

The scope of the policy is narrow on sectors that have a high influence on the equilibrium. As we discussed above, in the absence of network amplification the best policy is to do nothing. More generally, the theory shows that sectors are strategic for the government of country n the more they can be used to shield the economy from undue ex-post influence. For example, the government of country n wants to bolster ex-ante a sector with large economies of scale that can offer an alternative to hegemon inputs in order to become less dependent on the hegemon. Securing a supply of critical minerals or energy, or making sure there is enough domestic production of inputs that are essential to the military are typical policies of this type. Many of these anti-coercion policies seek to bolster home alternatives to hegemonic inputs. In doing so they fragment the global economy as countries put more weight on having high outside options. Our theory, see Section 3.3, warns about the dangers of these policies when carried out in an uncoordinated fashion.

3.2 Hegemon's Industrial and Trade Policies to Build Power

Just like governments in other countries, the hegemon's government also sets wedges on its domestic firms in the ex-ante stage of the Stackleberg game. Yet, the hegemon's objectives are quite different: it uses these ex-ante policies to shape its domestic economy to build up its international power. These policies include industrial, financial, and trade policies that boost those strategic sectors of the hegemons' economy that generate high dependence in foreign countries. The proposition below characterizes the optimal policies.

Proposition 4 *The hegemon's optimal wedges on domestic firms satisfy*

$$\tau_{m,ij} = -\overbrace{\sum_{k\in\mathcal{C}_m}\left(1+\frac{1}{\frac{\partial W_m}{\partial w_m}}\eta_k\right)\left[\left(\frac{\partial \Pi_k}{\partial z}-\frac{\partial \Pi_k^o}{\partial z}\right)\frac{dz}{dx_{ij}}+\left(\frac{\partial \Pi_k}{\partial P}-\frac{\partial \Pi_k^o}{\partial P}\right)\frac{dP}{dx_{ij}}\right]}^{\text{Building Power}}$$
$$\underbrace{-\left[\sum_{k\in\mathcal{I}_m}\frac{\partial \Pi_k}{\partial z}+\frac{1}{\frac{\partial W_m}{\partial w_m}}\frac{\partial u_m}{\partial z}\right]\frac{dz}{dx_{ij}}}_{\text{Domestic } z\text{-Externalities}} - \underbrace{X_m\frac{dP}{dx_{ij}}}_{\text{Terms-of-Trade}} \tag{12}$$

The hegemon has an incentive to manipulate prices and aggregate quantities to build its power over foreign firms. This motivation parallels its incentive to use (ex-post) its optimal contract with foreign firms to ask them to take costly actions that built its power by manipulating the global equilibrium (Proposition 1). However, the effect in the first line of equation (12) is ex-ante and on the hegemons' domestic firms.[14]

The rest of the hegemon's motivations for setting taxes on domestic firms parallel those of non-hegemonic countries in correcting domestic z-externalities and manipulating terms of trade. That is, the second line of equation (12) parallels the optimal input wedges in Proposition 3.

The building power motive can act in contrast with traditional objectives such as terms of trade manipulation. For example, a hegemon like China can find it optimal to subsidize its export-oriented manufacturing sectors and push down the price of its exports. Lowering the price of the exports is the opposite of what the terms of trade manipulation would imply. The rationale here is different: cheap exports will have a high penetration in foreign markets and discourage production of alternatives in foreign countries. In the presence of external economies of scale, in both China and foreign manufacturing sectors, this creates a foreign dependency on Chinese inputs that China can exploit ex-post to exert geoeconomic power. The threat of being cut off from Chinese manufacturing input is effective once other countries have too small of a scale of their domestic manufacturing sectors. Section 4 provides an application with similar logic to the US hegemon and its provision of financial services to the rest of the world.

3.3 Efficient Allocation and Noncooperative Outcome

To contextualize the outcome under hegemonic power and anti-coercion measures, we benchmark our results against two relevant cases. The first is the global planner's solution, which provides an efficiency benchmark. The second is the noncooperative outcome that would arise when all countries

[14]In contrast with the anti-coercion motivation of foreign countries, equation 12 does not contain terms related to the reoptimization of the hegemon's contract. Formally this follows from the Envelope Theorem: since the hegemon's contract is optimally set by the hegemon, marginal variations in its terms induce only second order welfare consequences from the hegemon's perspective. However, this does not imply that the hegemon does not consider how its domestic policies affect its contracting problem. Indeed, it does so precisely because it internalizes the effects that its domestic policies have on its power over foreign firms.

are able to set domestic policies, but no country is a hegemon.

Global Planner's Efficient Allocation. We assume that the global planner has the same instruments as individual governments and the hegemon, but maximizes global welfare with objective function:

$$\mathcal{U}^G = \sum_{n=1}^{N} \Omega_n \Big[W_n(p, w_n) + u_n(z) \Big], \tag{13}$$

where $\Omega_n > 0$ is the Pareto weight attached to country n. As is common in the literature, we eliminate the motivation for cross-country wealth redistribution by choosing Pareto weights that equalize the marginal value of wealth across countries, that is $\Omega_n \frac{\partial W_n}{\partial w_n} = 1$. Because from the perspective of the planner the hegemon's ex-post wedges are redundant with those of all governments' ex-ante wedges and because transfers are purely redistributive, we can consolidate the planner's problem into a single stage of choosing wedges τ on all sectors globally to maximize global welfare (equation 13). The following proposition characterizes the global planner's optimum.

Proposition 5 *The global planner's optimal wedges are*

$$\tau_{ij} = -\sum_{k \in \mathcal{I}} \frac{\partial \Pi_k}{\partial z_{ij}} - \sum_{n=1}^{N} \frac{1}{\frac{\partial W_n}{\partial w_n}} \frac{\partial u_n}{\partial z_{ij}} \tag{14}$$

The global planner uses wedges τ_{ij} solely for the purpose of correcting externalities arising from the vector of aggregate quantities z. This highlights three ways in which the global planner's use of wedges differs from the optimal ex-ante policies of individual countries. First, given the global planner lacks a redistributive motive, the global planner does not target terms-of-trade manipulation, which redistribute wealth across countries but are, at best, zero sum. Second, whereas individual country governments only set wedges to correct externalities borne by domestic firms and consumers, the global planner accounts for externalities that fall upon firms and consumers in all countries. Third, individual country governments care about the externalities on their firms' outside options, due to anticipated coercion by the hegemon, whereas the global planner cares about the externalities on firms' inside options.[15]

Proposition 5 also illustrates the points of commonality and difference between the hegemon and the global planner. For illustrative purposes, Figure 3 builds on Figure 2 while specializing the model to have constant prices (Definition 1). For a given sector i in country n, it plots the marginal

[15] It is also notable that whereas individual countries' wedge formulas include network amplification, the global planner's optimal wedges do not. Intuitively, this is because the global planner has a complete set of instruments on firms, and so can directly manage externalities associated with each activity separately. In contrast, individual countries and the hegemon possess limited instruments, in that they can only control a subset of firms in the global economy. Although the global planner does internalize network amplification through prices, the resulting pecuniary externalities are purely redistributive and so do not generate a net welfare impact.

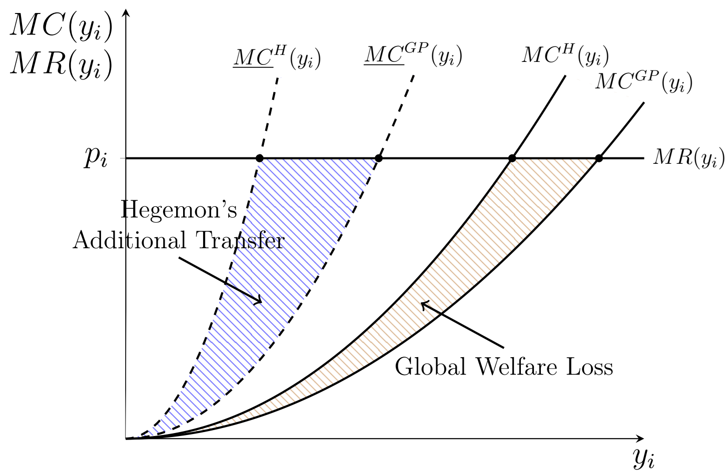


Figure 3: Global Planner and Hegemon Equilibria

cost and marginal revenue curves for the global planner's solution, denoted with superscript GP, and the hegemon's solution, denoted with superscript H. The marginal revenue curve is constant at p_i given our assumption of constant prices. Proposition 5 shows how the global planner uses wedges to increase firm profits on their inside option by internalizing production externalities, that is shifting the curve MC^{GP} to the right. The global planner places no weight on how the marginal cost curve at the outside option moves.

Consider a hegemon that implemented the same wedges as the global planner. A firm that rejected the hegemon's contract would then face the marginal cost curve $\underline{MC}^{GP}(y_i)$, and the hegemon would extract as a transfer the difference in profits between the inside option and the outside option. This is the area (below p_i) between the curves $\underline{MC}^{GP}(y_i)$ and $MC^{GP}(y_i)$. Generically, for a given anti-coercion policy set by all other countries, this is not the optimal solution for the hegemon since it can manipulate the equilibrium to shift the outside option marginal cost curve $\underline{MC}^H(y_i)$ further to the left, even though doing so moves the economy away from the global planner's efficient solution by shifting the inside option marginal cost curve $MC^H(y_i)$ also to the left. That is, firms face higher costs and produce less on path, leading to a global welfare loss (the shaded brown area). The hegemon, like the planner, perceives this loss in firms' profits, but finds it optimal whenever it is more than offset by the decrease in the firms' outside option. The increase in the transfer that the hegemon can extract is the blue shaded area.

Compared to the planner, the hegemon manipulates the global equilibrium to increase the dependency of foreign firms on inputs it controls, increasing what it can extract from them. In this sense, the hegemon generates hyper-globalization by over-integrating foreign economies with its own economic network. Anti-coercion policy tries to limit this process. Each country pursues anti-coercion to push the outside option marginal cost curve $\underline{MC}^H(y_i)$ further to the right. Since these policies are uncoordinated among the foreign governments, they risk globally destroying welfare as each country over-fragments the global economy to improve its own economic security. We turn to this possibility next and in the application of Section 4.4.

Noncooperative Outcome. Our second benchmark is the noncooperative outcome that arises when all countries set their own policies on domestic firms, but no country is a hegemon.

Proposition 6 *Absent a hegemon, the optimal wedges of country n satisfy*

$$\tau_{n,ij} = -\left[\sum_{k\in\mathcal{I}_n}\frac{\partial\Pi_k}{\partial z} + \frac{1}{\frac{\partial W_n}{\partial w_n}}\frac{\partial u_n}{\partial z}\right]\frac{dz}{dx_{ij}} - X_n\frac{dP}{dx_{ij}}$$

In the absence of a hegemon, each country has a motivation to correct z-externalities that fall on the domestic economy and to manipulate its terms-of-trade. However, unlike anti-coercion against a hegemon that revolved around maximizing the outside option, the government of country n now values only the inside option of all of its firms. The country n government deviates from the global planner's efficient wedges both in ignoring externalities that fall outside of its country and in manipulating the terms-of-trade. In general, this noncooperative equilibrium could be better or worse for the (non-hegemonic) countries than the equilibrium with a hegemon and anti-coercion. As discussed above, the hegemon shares features of the global planner, thus adding value to foreign countries, but also distorts the equilibrium in its favor. Similarly, uncoordinated anti-coercion policy can end up making all countries worse of by destroying the gains from global integration. Indeed, our application in Section 4.4 proves a case in which the noncooperative equilibrium without a hegemon would have been welfare improving for all non-hegemonic countries.

4 Finance Power and Fragmentation

We provide an application of the general framework derived in the previous sections to both illustrate better the role of strategic complementarities in production and analyze the importance of financial services as a tool of coercion.

Financial services have become a major tool of either implicit or explicit coercion for the United States. Instances have included extensive financial sanction packages on Iran and Russia, pressure on HSBC to reveal business transactions related to Huawei and its top executives, as well as pressure on SWIFT to monitor potential terrorists' financial transactions. The US heavy use of financial services to pressure foreign governments and private companies arises from the dominance of the United States and the dollar-centric financial system. The dominance is both in terms of reach, i.e. most world entities rely either directly or indirectly on this system, and in terms of absence of a viable alternative, i.e. only poor substitutes are available on the margin. For example, in a report assessing the feasibility of US sanctions on China, former Deputy Assistant U.S. Trade Representative for Investment and member of the National Security Council Emily Kilcrease stresses that: "The United States has a distinct advantage in sanctions intended to place pressure on China's economy, based on China's continued reliance on the U.S. dollar for its trade and financial operations internationally

[...] Financial sanctions are among the most oft-used and powerful ways that the United States has to exert macroeconomic pressure. [...] Most of the financial sanctions leverage the privileged position of the United States in the global financial infrastructure." (Kilcrease (2023)).

Bartlett and Ophel (2021) emphasize the crucial role of the US dominance in financial services in exerting influence over foreign entities and activities that involve no direct US role. Traditionally, sanctions involve legal actions over activities that include at least one US entity or over which the US has legal jurisdiction. "In contrast, secondary sanctions target normal arms-length commercial activity that does not involve a U.S. nexus and may be legal in the jurisdictions of the transacting parties. [...] Secondary sanctions present non-U.S. targets with a choice: do business with the United States or with the sanctioned target, but not both. Given the size of the U.S. market and the role of the U.S. dollar in global trade, secondary sanctions provide Washington with tremendous leverage over foreign entities as the threat of isolation from the U.S. financial market almost always outweighs the value of commerce with sanctioned states." (Bartlett and Ophel (2021)).[16]

Our model captures these crucial elements of US policy. First, we model financial services as a sector with strong strategic complementarities and show that a global planner, and even more so a hegemon, would want to engineer an equilibrium in which one financial sector is dominant globally. From the global planner's perspective, there are efficiency gains from everyone using the same financial services. It is a standard argument about strategic complementarities in goods trade that also adapts to financial services. The hegemon has incentives to integrate the global financial system even more than the planner, i.e. make its own system even more dominant, in order to maximize its power. This can lead to financial hyper-globalization if the hegemon is left unchecked.

Second, at the core of our model is a mechanism for the hegemon to demand that a foreign entity cease an activity with a third party (i.e., imposing a high wedge). The hegemon has no direct control or legislative power over the foreign entity or the activity that is being affected. The hegemon uses a threat of suspension of access to US financial services to induce the foreign entity to voluntarily comply with its requests. For example, the US obtained both disclosures of information and suspension of services to certain entities in Iran and Russia by the messaging payment system SWIFT despite having no direct jurisdiction over this Belgian cooperative society. Similarly, the US put pressure on a foreign bank (HSBC) in its pursuit of sanctions against a foreign company (Huawei) and its management (Meng Wanzhou, the company's CFO and the daughter of

[16] The authors further remark that many of these threats are effective but not carried out in equilibrium: "Very few secondary sanctions have been enforced on European companies due to the high level of compliance by European firms. This is because access to the U.S. correspondent banking and dollar clearing systems is critical for their operations. Additionally, many European banks maintain American operations, such as branches in New York City, that fall directly under U.S. jurisdiction and therefore are subject to U.S. law enforcement. Together, these factors lead European financial institutions to comply with U.S. sanctions, regardless of their governments' policies. The high level of compliance by European financial institutions means it would be difficult for non-financial European firms interested in doing business with Iran to find a bank to process their transactions, and if subjected to U.S. sanctions, would be swiftly cut off from banking services in their own countries."

its founder).[17]

Third, we study how other countries might want to pursue anti-coercion policies to induce their domestic firms to switch to a home financial services sector that is less efficient but insulates the country from the hegemon's coercion. For example, following an earlier sanctions package applied to Russia in 2014, Russia developed a domestic messaging system called SPFS (System for Transfer of Financial Messages) that potentially helped Russia's cushion the blow of having some of its banks disconnected from SWIFT in 2023. China has been developing and growing its own messaging and settlement system CIPS (Chinese Cross-Border Interbank Payment System) in an attempt to isolate itself from potential US coercion, but also as a mean to offer an alternative to other countries that might fear US pressure.[18] India also launched its own system SFMS (Structured Financial Messaging System). For now, these alternatives are inefficient substitutes, but highlight a fragmentation response to diverging political and economic interests with the US hegemon.

4.1 Setup

We specialize the general model in the previous sections to the configuration in Figure 4. This set-up is minimalist to capture the essence of the problem. The global economy consists of the US hegemon (country m) and foreign countries $n = 1, \ldots, N$. We assume constant prices (Definition 1) and that consumer utility does not depend on the vector of aggregates z, that is $u_n(z)$ is constant for all consumers. This allows us to focus on macroeconomic amplification through production externalities with no terms of trade manipulation motives. The US has one sector, the financial services sector denoted by j. Sector j produces out of a single factor ℓ_m, so that production is $f_j(\ell_j) = \frac{1}{p_j}\ell_{jm}$. Each foreign country n has three sectors, h_n, d_n, and i_n, and a single local factor, ℓ_n. Sector h_n, "home financial services sector", produces solely out of the local factor, $f_h(\ell_{hn}) = \frac{1}{p_h}\ell_{hn}$.

Sector i_n, "home financial intermediation sector", is an aggregator of financial services provided by the home sector h and imported from the US sector j. Namely, the intermediary sector i_n produces composite financial services out of both h_n and j with a CES production function,

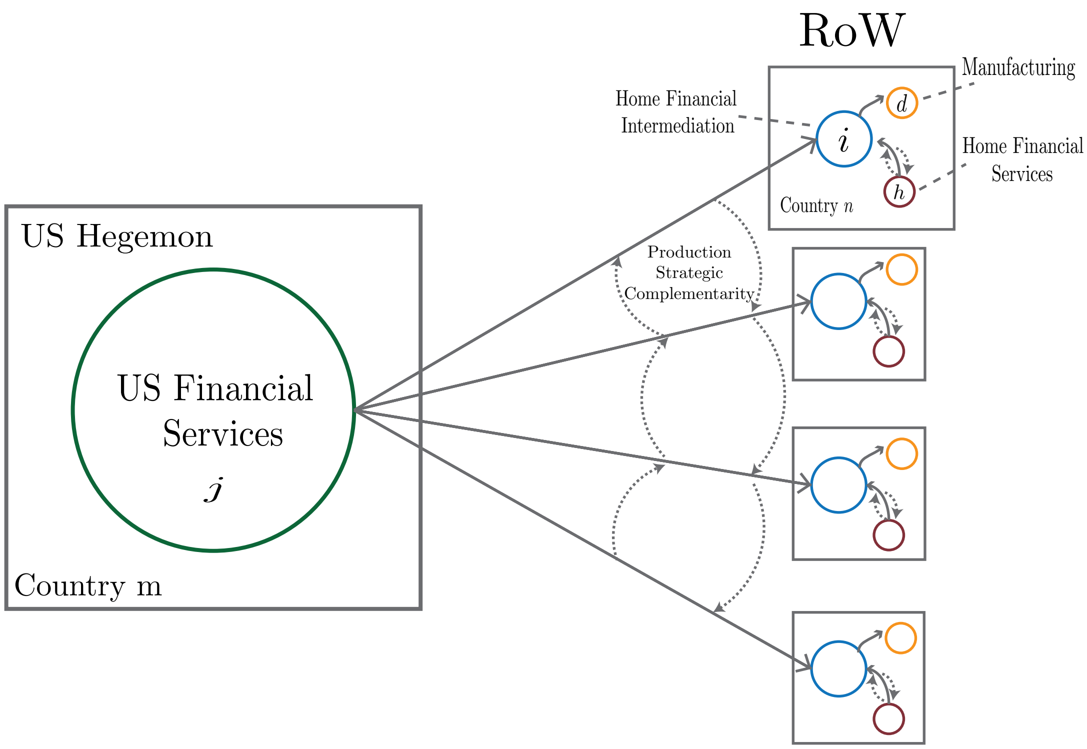
$$f_i(x_{i_nj}, x_{i_nh_n}, z) = \left(A_j(z)x_{i_nj}^{\sigma} + A_{i_nh}(z)x_{i_nh}^{\sigma}\right)^{\beta/\sigma},$$

where we use the notation f_i to indicate symmetry across countries. The parameter $\beta \in (0, 1)$ governs the extent of decreasing returns to scale (for fixed A's). The parameter σ governs the elasticity of substitution across the two inputs in the production basket. We assume that $0 < \beta < \sigma$,

[17] Both examples are discussed in detail by Farrell and Newman (2023). The pressure and legal actions often involved either sub-entities of the foreign group that are present in the US (e.g. a US based SWIFT data center) or the threat of suspension of dealing with US entities (see also Scott and Zachariadis (2014) and Cipriani et al. (2023)).

[18] Clayton et al. (2022) point out that one of the reasons China is liberalizing access to its domestic bond market and also letting some domestic capital go abroad is to create two-way liquidity in RMB bonds that can serve as a store of value to complement the payment system (means of payment).

Figure 4: **US Financial Networks, Coercion, and Fragmentation**



Notes: Figure depicts the model set-up for the application on U.S.-centric global financial services.

so that the hegemon's financial service and the home alternative are substitutes in production.

Productivity $A_j(z) = \frac{1}{N}\sum_{n=1}^{N} \overline{A}_j z_{i_n j}^{\xi_j \sigma}$ of the hegemon's financial services and $A_{i_n h}(z) = \overline{A}_h z_{i_n h}^{\xi_h \sigma}$ of the home alternative are both non-decreasing in their arguments. This captures a strategic complementarity in use of either service among financial firms within sector i_n. There is also a strategic complementarity across sectors i_n in their use of the US financial services j.[19] The parameters $\xi_j \geq 0$ and $\xi_h \geq 0$ govern the economies of scale, with higher values generating stronger spillovers. We restrict $(1+\xi_j)\beta < 1$ and $(1+\xi_h)\beta < 1$ for concavity in the aggregate production function. We restrict $(1+\xi_j)\left(1-\frac{\beta}{\sigma}\right) \leq 1$ so cross-country use of j are complements in production.[20]

In each country, the manufacturing sector d_n produces using the local factor. We assume that,

[19] This set-up abstracts from a number of realistic but inessential elements. First, it collapses many distinct financial services into a broad sector. Messaging systems, settlement systems, clearing, correspondent banks, custodians, working capital loans and lending are of course meaningfully distinct. Each of them could be separately modelled with full foundations. Instead, we capture two essential and common features: these services are an important input into production (payments to acquire inputs and collect revenues, transfers to allocate production capital), and they feature strategic complementarities across firms and sectors. Second, we abstract from multiple layers in the network and assume the services are directly provided by the US entities. Our framework can clearly handle indirect threats via foreign entities that themselves are connected to the US (e.g. SWIFT).

[20] For technical reasons, we need to impose a small lower bound $\underline{x} > 0$ on use of input h, that is $x_{i_n h} \geq \underline{x}$.

in order to operate, the manufacturer has to purchase a value of financial services that is a constant fraction of its total expenditure on other inputs. That is, if the manufacturer wants to operate at a scale $p_h \ell_{d_n n}$ (the cost of its factor input), it has to also purchase financial services $p_i x_{d_n i_n} = \gamma p_h \ell_{d_n n}$ for an exogenous $\gamma \in (0, 1)$. Therefore the profit function of the manufacturing sector is:

$$p_d \ell_{d_n n}^{\beta} - (1 + \gamma) p_h \ell_{d_n n}.$$

This simple formulation, adapted from Bigio and La'O (2020), has two advantages. First, it captures a typical role of finance as an input in other sectors that is necessary for firms to operate (payments, working capital loans, commercial credit). Second, it is tractable and fits nicely in the general theory of the previous section.[21] We keep the manufacturing sector intentionally streamlined in order to focus on the intermediary sector, but it is easy to extend it to multiple sectors and more inputs.[22]

One interpretation is that the manufacturing firm faces a working capital financing constraint that requires it to pay its workers' wages before output is produced. To make this interpretation concrete, suppose that before production occurs, the firm hires its workers and has to immediately pay their wages $p_h \ell_{d_n n}$. To pay for these wages, the firm has to take out a loan from the intermediary at an interest rate of γ. Its final payment to the intermediary is therefore $(1 + \gamma) p_h \ell_{d_n n}$. The net cost to the firm of the loan is the interest payment $\gamma p_h \ell_{d_n n}$ while this interest payment is also the net revenue for the intermediary. Under this interpretation, $p_i x_{i_n d_n}$ is the interest payment made.

Another interpretation, akin to a payment system, is that γ is the per-dollar fee for making a payment for inputs. Under this interpretation, to cover payments of $p_h \ell_{d_n n}$, the firm has to spend $(1 + \gamma) p_h \ell_{d_n n}$, with payment $\gamma p_h \ell_{d_n n}$ going to the financial service provider. That is, $p_i x_{i_n d_n}$ is the total payment received by the intermediary for its payment services.

4.2 Global Financial System: Planner and Noncooperative Outcomes

The global planner's efficient allocation and the noncooperative outcome without a hegemon from Section 3.3 simplify greatly in this setting.

Global Planner. Since there are no externalities that fall directly on consumers, $\frac{\partial u_n}{\partial z_{i_n j}} = \frac{\partial u_n}{\partial z_{i_n h}} = 0$, an increase in use of the hegemon's services j by an individual country's intermediary sector spills over to the productivity of every other country's intermediary sector. In particular, the global spillover comes exclusively from the productivity spillover, related to curvature ξ_j. The

This constraint rules out a hegemon optimum with $x_{i_n h} = 0$, but does not bind.

[21]The constant expenditure share on financial services makes the firm problem extremely similar to that of a firm that produces using a Cobb Douglas production function of industrial inputs and financial services, but that does not face a financial constraint. See Appendix A.3.5 for the isomorphism.

[22]Given that the local factor is used both in manufacturing and in the financial services sector, we assume that its supply is sufficiently abundant that these sectors are never constrained in sourcing the factor.

following corollary of Proposition 5 shows that the global planner's optimal wedge formulas simplify to subsidies on use of both the hegemon's financial services and the home alternative.

Corollary 1 *The global planner's optimal wedges are*

$$\tau_{i_n j} = -\frac{\xi_j}{1+\xi_j} p_j, \qquad \tau_{i_n h} = -\frac{\xi_h}{1+\xi_h} p_h. \tag{15}$$

The global planner subsidizes use of both home and US financial services to induce intermediaries to internalize the positive spillover to other intermediaries within (and across) countries of greater use of financial services. That is, the planner's equilibrium features more use of financial services by sectors i_n. The magnitude of the global planner's subsidy on j is the cost of the input, p_j, times the magnitude of the spillover measured by the elasticity of A_j with respect to greater use $\overline{z}_j$, given by ξ_j. Intuitively, a larger strategic complementarity, that is a larger elasticity, motivates the planner to increase adoption by all intermediaries in order to capitalize on the productivity gains through larger adoption. The same logic underlies the subsidy $\tau_{i_n h}$ of the home alternative. Subsidies are bigger the stronger the economies of scale (the higher the ξ's).

We can use this application to further understand the mechanisms underlying Figure 3 that illustrates the planner's solution. For a specific intermediary sector i in country n, it plots the marginal cost MC and marginal revenue MR curves of producing output y_i. The marginal revenue curve is constant at p_i given our assumption of constant prices, and the marginal cost curve is increasing in y_i given our decreasing returns to scale, with

$$MC(y_i) = \left(\left(\frac{A_{ih}^{\frac{1}{\sigma}}}{p_h + \tau_{ih}} \right)^{\frac{\sigma}{1-\sigma}} + \left(\frac{A_j^{\frac{1}{\sigma}}}{p_j + \tau_{ij}} \right)^{\frac{\sigma}{1-\sigma}} \right)^{-\frac{1-\sigma}{\sigma}} \left(\beta y_i \right)^{\frac{1}{\beta}-1}.$$

when intermediary i faces wedges τ_{ih} and τ_{ij}. Intermediary profits, which here coincide with welfare, are the area between the $MR(y_i)$ and $MC(y_i)$ curves. The planner solution in Corollary 1 maximizes this area by making the intermediaries face lower prices (negative wedges) that stimulate usage of financial services that have aggregate economies of scale (i.e., increasing A_j and A_h). The planner is effectively manipulating the marginal cost curve by setting prices at $p_h + \tau_{ih}$ and $p_j + \tau_{ij}$ and inducing sectoral input productivities of A_j and A_h that themselves depend on the taxes via each intermediary's choice of inputs.

Noncooperative Outcomes. We specialize the result of Proposition 6 to characterize the noncooperative outcome without a hegemon in this application. For simplicity, we take $N \to \infty$.[23]

Corollary 2 *Let $N \to \infty$. Absent a hegemon, the optimal wedges of country n are*

$$\tau_{n,i_n j} = 0, \qquad \tau_{n,i_n h} = -\frac{\xi_h}{1+\xi_h} p_h.$$

[23] Absent the limit, each country would only internalize the portion of the global productivity spillover that fell on its domestic economy, and so would impose too low of a subsidy on j.

Each government n places the same subsidy on the home alternative as did the global planner because the government internalizes the strategic complementary in the use of the home alternative since the benefits accrue entirely to the domestic economy. On the other hand, although country n benefits from the use of the hegemon's system, its government does not internalize the global strategic complementarity in its adoption and places no tax or subsidy on the use of the hegemon's financial services j, that is $\tau_{n,i_n j} = 0$. The noncooperative outcome, therefore, features efficient subsidies of the home alternative, but no subsidies of the global alternative. As a result, the noncooperative outcome features too much use of the home alternative and too little of the hegemon's financial services. Compared to the planner solution the global economy is too financially fragmented, which is inefficient.

4.3 Hegemon's Financial Power

We specialize the hegemon's optimal contract of Proposition 1 to this application. Throughout this application, we simplify the analysis by relaxing the hegemon's non-negativity constraint on transfers.[24]

Starting from the wedge formula in Proposition 1, all terms except for the participation constraint term related to z-externalities are zero in this application. Since the punishment for rejecting the contract is exclusion from using the hegemon's financial services j, the profits at the outside option of intermediary i_n (excluding remitted revenues from the wedges) are

$$\Pi^o_{i_n} = \max_{x^o_{i_n h}} p_i \left(\overline{A}_h^{1/\sigma} z_{i_n h}^{\xi_h} x^o_{i_n h} \right)^\beta - (p_j + \tau_{n,i_n h}) x^o_{i_n h}.$$

Importantly, $\Pi^o_{i_n}$ is a function of $z_{i_n h}$, but is not a function of A_j. Since the marginal value of wealth is also 1 and since $\eta_{i_n} = 0$ (given the relaxed non-negativity constraint), the hegemon's wedge formulas reduce to $\tau_{m,ij} = -\sum_{n=1}^N \frac{\partial \Pi_{i_n}}{\partial z_{ij}}$ and $\tau_{m,ih} = -(\frac{\partial \Pi_i}{\partial z_{ih}} - \frac{\partial \Pi^o_i}{\partial z_{ih}})$. These equations highlight the sources of alignment and misalignment between the hegemon and the global planner. There is alignment with respect to the externality correction on use of financial services j, which is not used by firms at their outside option. In contrast, the hegemon aims to maximize the gap between the inside and outside options for the home alternative, whereas the global planner maximizes the inside option. Exploiting symmetry of domestic policies, the following corollary of Proposition 1 characterizes the hegemon's optimum.

[24] In a symmetric equilibrium in which all countries in equilibrium impose the same wedges ex-ante, the Lagrange multipliers η_k across intermediaries would be the same and would drop out in equation 5. This would yield the same wedge formula for the hegemon. Relaxing the non-negativity constraint eases analysis of the anti-coercion problem in which a country considers unilaterally deviating from the symmetric equilibrium. Even with a binding non-negativity constraint, countries would still want to impose large tariffs to at least the point where the constraint bound, for the same reasons as underlie our analysis.

Corollary 3 *When foreign countries' domestic policies are symmetric, the hegemon's optimal wedges are*

$$\tau_{m,i_nj} = -\frac{\xi_j}{1+\xi_j}\left(p_j + \tau_{n,i_nj}\right), \qquad \tau_{m,i_nh} = \frac{\xi_h}{1+\xi_h}\left(\frac{x^o_{i_nh}}{x^*_{i_nh}} - 1\right)\left(p_h + \tau_{n,i_nh}\right). \tag{16}$$

Comparing the hegemon's optimal wedges to those of the global planner, two key properties emerge. First, the hegemon sets the wedge on the use of its financial services j according to the same formula as the global planner, up to accounting for the effects of wedges imposed by other governments on the use of j. In particular, if other countries are not pursuing anti-coercion policies, that is $\tau_{n,i_nj} = 0$, then the hegemon's wedge coincides with that of the global planner.

Intuitively, the hegemon, like the global planner, internalizes the positive spillover generated by increasing intermediaries' use of j. Whereas the global planner values this increase in profits directly, the hegemon instead values it indirectly because higher profits allow it to extract a larger transfer. This aligns the hegemon's incentives with the global planner's in terms of choice of the tax on input j. On the other hand, if governments were on average imposing wedges on the hegemon's financial services, the hegemon would perceive a higher cost to these foreign intermediaries using more of its services, analogous to a higher price p_j. This would result in a higher unit subsidy set by the hegemon, but the same proportional subsidy to the total effective price $p_j + \tau_{n,i_nj}$. Intuitively, a higher effective price means that global use of the hegemon's financial services is low, and the marginal productivity benefit of increasing usage is high. This motivates larger subsidies from the hegemon to increase usage. On net, however, the hegemon's subsidy rises at less than a one-for-one rate with increases in anti-coercion taxes on j.

In contrast, compared with the global planner, the hegemon shifts towards discouraging the use of home financial services h. The shift is driven by two opposing forces. On the one hand, higher on-path intermediary profits lead the hegemon to want to subsidize h, exactly as it did for j, to increase the size of the transfer payment it can extract by increasing the inside option. On the other hand, increasing productivity A_h of home financial services also increases the outside option of a firm that opted to reject the hegemon's contract and rely only on home financial services. The hegemon, therefore, trades off the on-path profit gains against not wanting to make rejecting the contract too appealing. As a result, the hegemon shifts towards a positive wedge on home financial service usage by i. There is no similar incentive to manipulate the outside option by changing A_j, precisely because the threatened punishment is being cut off from using j entirely.

Returning to Figure 3, the marginal cost curve faced by an intermediary that rejects the hegemon's contract is equivalent to taking $\tau_{ij} \to \infty$ for that specific firm (but not other firms in the sector), yielding

$$\underline{MC}(y_i) = \left(\frac{A_{ih}^{\frac{1}{\sigma}}}{p_h} + \tau_{ih}\right)^{-1}\left(\beta y_i\right)^{\frac{1}{\beta}-1}.$$

As discussed in Section 3.3, the hegemon sets wedges that shift this curve further to the left compared to the planner. This comes with the global welfare cost of also shifting the inside option marginal cost curve to the left, thus reducing on path profits. However, the hegemon is still better off since the inside option shifts to the left less than the outside option, maximizing the transfers that the hegemon can extract. The hegemon is getting the rest of the world "addicted" to its financial services to increase the power it can achieve by threatening withdrawals, increasing use of its system and decreasing use of alternatives. We make this intuition on changes in usage formal in the next proposition.

Financial Hyper-Globalization. To shed light on how the hegemon operates and the potential motivations for anti-coercion policies, we compare the allocations under the hegemon's optimum in the absence of anti-coercion policies to the allocations of the global planner. In particular, we show that the hegemon increases use of its financial services and decreases use of home financial services relative to the global planner's optimum.

Proposition 7 *In the absence of anti-coercion policies ($\tau_n = 0$), the hegemon's optimum has weakly higher use of its financial services $x_{i_n j}$ and weakly lower use of home alternatives $x_{i_n h}$ than the global planner's optimum.*

This proposition maps the difference in the hegemon's optimal wedges compared to the planner into the difference in terms of allocations. Intuitively, because home and hegemon's financial services are substitutes in production ($0 < \sigma < \beta$), reducing the subsidy on home financial services has the effect of pushing intermediaries towards greater use of hegemon's financial services. The hegemon, therefore, generically promotes "financial hyper-globalization" that loads too heavily on global use of its financial services. By encouraging firms to over-use the hegemon's services and under-use the home alternative, the hegemon makes rejecting its own contract more costly and increases the power it has over foreign entities, enabling it to collect larger transfers.

4.4 Financial Anti-Coercion Policy: Fragmentation and Welfare

We start by characterizing the positive effects of anti-coercion policies on the global equilibrium, accounting for the endogenous response of the hegemon. This analysis parallels Proposition 2 in the general framework. We assume all countries apart from a single country n have adopted the same domestic policies. We obtain the following results on global amplification of country n changing anti-coercion policy.

Proposition 8 *Suppose that all countries except for country n have adopted symmetric anti-coercion policies, then, accounting for the hegemon's endogenous response:*

1. *An increase in country n wedge on the hegemon's financial services j lowers every country's use of j and raises every country's use of their home alternative h:*

$$\frac{\partial z_{i_r j}}{\partial \tau_{n,i_n j}} \leq 0, \quad \frac{\partial z_{i_r h}}{\partial \tau_{n,i_n j}} \geq 0 \quad \forall\ r = 1, \ldots, N$$

2. *For $0 \leq \xi_h \leq \overline{\xi}_h$ (and upper bound defined in the proof), an increase in country n subsidy on the home alternative h lowers every country's use of j and raises every country's use of their home alternative h, that is:*

$$\frac{\partial z_{i_r j}}{\partial \tau_{n,i_n h}} \geq 0, \quad \frac{\partial z_{i_r h}}{\partial \tau_{n,i_n h}} \leq 0 \quad \forall\ r = 1, \ldots, N$$

Intuitively, as country n increases the wedge on its intermediaries' usage of the hegemon financial services, the hegemon on the margin finds it too expensive to fully offset country n's policy. As a result, country n intermediaries use less of the hegemons' financial services. Due to the strategic complementarity, the hegemon's financial services j becomes less productive globally, and so also becomes less attractive to intermediaries in other countries. This increases the cost to the hegemon of asking intermediaries in other countries to use its services as opposed to their home alternative, leading to a re-balancing of other countries away from the hegemon's services and towards their own home alternatives. A pursuit of anti-coercion by a single country thus increases global fragmentation, shifting not only its own intermediaries but also all other countries away from the hegemon's financial services and towards home alternatives. This is the "fragmentation doom loop" applied to financial services.

We next characterize optimal anti-coercion policies adopted by country n, taking as given the symmetric domestic policies of other (non-hegemonic) countries. The following result is a counterpart of Proposition 3 in the general theory. It shows that optimal anti-coercion policies result in global fragmentation.

Proposition 9 *Suppose all other (non-hegemonic) countries have adopted symmetric anti-coercion policies, an optimal anti-coercion policy of country n is to set $\tau_{n,i_n j} \to \infty$ and $\tau_{n,i_n h} = -\frac{\xi_h}{1+\xi_h} p_h$. Therefore, country n subsidizes its home alternative and prevents its intermediaries from using the hegemon's financial services.*

The optimal policy of country n results in international fragmentation, whereby country n prohibits use of the hegemon's system entirely ($\tau^x_{n,i_n j} \to \infty$) and relies exclusively on the home alternative. Intuitively, the hegemon would extract all gains from international integration ex post, leaving country n in the same position as if relied exclusively on the home alternative. This means that any use $x_{i_n j} > 0$ of the hegemon's services crowds out use of the home alternative, lowering its productivity and lowering the outside option. As a result, country n finds it optimal to prohibit use of the hegemon's services entirely, resulting in full fragmentation from the global financial system. Once country n is relying exclusively on its home alternative, then its subsidy $\tau_{n,i_n h} = -\frac{\xi_h}{1+\xi_h} p_h$ is of course set efficiently. The results in Proposition 9 are both sharp and stark. As the general theory makes clear, the full fragmentation is an extreme outcome, but anti-coercion policy in general would have a tendency toward fragmentation in the sense of moving away from what the hegemon controls in order to increase the outside option.

Finally, we characterize how the presence of hegemonic power and anti-coercion policies affect welfare, both at the global level and from the perspective of individual countries. In doing so, we compare the welfare outcomes under the noncooperative outcome, the equilibrium with a hegemon and no anticoercion policies, and the equilibrium with a hegemon and anti-coercion policies. The following result summarizes the welfare consequences as $N \to \infty$.

Proposition 10 *Let $N \to \infty$. The following welfare rankings hold:*

1. *The noncooperative outcome without a hegemon* Pareto *dominates the outcome with optimal anti-cercion and a hegemon.*
2. *Let $\xi_h = 0$, then countries do not pursue anti-coercion, $\tau_n = 0$, and the hegemon implements the global planner's efficient wedges. However, every country $n \neq m$ is worse off than in the noncooperative outcome without a hegemon because the hegemon extracts positive transfers.*

The first part of the proposition shows that the noncooperative outcome without a hegemon always *Pareto* dominates the anti-coercion equilibrium with a hegemon. That is, the international fragmentation induced by each country attempting to shield its economy from hegemonic power is inefficient. In the noncooperative outcome without a hegemon, country n efficiently subsidized its home alternative, $\tau_{n,i_n h} = -\frac{\xi_h}{1+\xi_h}$, but put neither a tax nor a subsidy on the hegemon's financial services. Thus although the noncooperative outcome features under-utilization of the hegemon's system relative to the global planner's solution, it still features a less distorted use compared with the fragmentation outcome, which features a complete prohibition on the hegemon's financial services. As a result, a world with a global hegemon in which anticoercion policies seek to mitigate the hegemon's influence yields a worse outcome than a world without a global hegemon.

Our results offer a stark warning for the current policy impetus of countries pursuing economic security agendas in uncoordinated fashion. As each country tries to insulate itself from foreign coercion, it kicks into motion a fragmentation doom loop that makes other countries want to insulate themselves even more. The global outcome is inefficient fragmentation that destroys the gains from trade.

The second part of the proposition takes the limiting case of $\xi_h = 0$, i.e. no economies of scale on the home alternatives, in which the hegemon in fact implements the global planner's optimal wedges and all other countries do not want to pursue anti-coercion policy. Thus total world-level surplus necessarily increases relative to the noncooperative outcome. Nevertheless, every country apart from the hegemon is worse off than in the noncooperative equilibrium without a hegemon because the hegemon extracts strictly positive transfers. Intuitively, country welfare is determined by use of the home alternative in isolation, which must necessarily leave these countries worse off than if they had access to both the home alternative and the hegemon's financial services. As a result, the hegemon's extraction of not only the increase in total surplus but also the gap relative to the outside option leaves other countries worse off. This benchmark helps to understand why countries pursue the anti-coercion policies that ultimately result in inefficient fragmentation.

5 Using the Model as an Empirical Guide

In this section, we use our model as a guide for examining the sources of geoeconomic power around the world. We show that a parameterized version of our model admits a simple measure of geoeconomic power and we use a simple sufficient statistic approach to demonstrate the importance of finance in American power. Our estimate of the sources of geoeconomic power treats the export of financial services symmetrically with goods trade and is therefore a natural starting point for this exercise. However, we also highlight how the challenges in the measurement of financial service trade make a more systematic estimation of the relative power arising from goods trade and international finance an important next step. Finally, we show that the model admits a gravity structure than can be estimated to infer changes in the weight governments put on geopolitical alignment in their trading relationships, and discuss how the model can be used in the future to identify which industries and relationships the hegemon targets for geoeconomic influence.

5.1 The Financial System and the Sources of Geoeconomic Power

We begin by demonstrating how a parameterized version of our model admits a simple measurement of geoeconomic power. We consider the world divided into different industries $J \in \mathcal{J}$, where each country has a sector associated with industry J. Suppose that a firm has nested CES production out of inputs,

$$f_i(x_i) = \left(\sum_{J \in \mathcal{J}} \alpha_{iJ} \sum_{n} \alpha_{iJn} \, x_{iJn}^{\frac{\sigma_J - 1}{\sigma_J}} \right)^{\frac{\sigma_J}{\sigma_J - 1} \frac{\rho - 1}{\rho}} \Bigg)^{\frac{\rho}{\rho - 1} \beta},$$

where σ_J is the elasticity of substitution of goods produced by different countries within a given industry J, ρ is the elasticity of substitution across industries, and β measures decreasing returns to scale. Here, we consider a tractable case in which the outer nest is Cobb-Douglas ($\rho = 1$). Following the derivation in Clayton et al. (2023), we show that the loss of value to firm i from losing access to country n's industry J can be written as:[25]

$$\log \nu_i(\mathcal{J}_i) - \log \nu_i(\mathcal{J}_i \backslash \{(Jn)\}) \approx \frac{\beta}{1-\beta} \times \frac{1}{\sigma_J - 1} \times \Omega_{iJ} \times \omega_{iJn} \tag{17}$$

where Ω_{iJ} is the share spent by firm i on industry J out of its total expenditure, and ω_{iJn} is the share of expenditure of firm i on country- n-produced industry-J goods as a share of total spending by firm i on industry J. This is the loss for a single firm of a single input from a single country. If country n is small at the global level there is a representative firm at the country level, then with a Cobb-Douglass outer nest, we can write the loss to country n from losing access to all the

[25] See Clayton et al. (2023) Online Appendix B.2.3.

hegemon's goods as (ignoring the returns to scale term)[26]

$$\tilde{\nu}_n \equiv \sum_{J \in \mathcal{J}} \left(\log \nu_n(\mathcal{J}_n) - \log \nu_n(\mathcal{J}_n \setminus \{(Jm)\}) \right) \tag{18}$$

This captures how much of an economic loss country n experiences if it loses access to the hegemon's goods.[27] Because the size of this loss determines the value to country n of retaining access to the hegemon's inputs, it determines the cost to country n of actions (wedges, transfers, or political concessions) that the hegemon can ask for before the entities in that country prefer to decline the contract. This is a natural measure of the hegemon's power over a country n. This measure of the power that a hegemon has over countries around the world is motivated by Hirschman (1945), and our calculation is similar to Hausmann et al. (2024) who measure the cost that the United States and Europe can impose on Russia via export controls in the Baqaee and Farhi (2022) framework. More generally, our measure parallels the sufficient statistics for welfare gains from international trade in Arkolakis et al. (2012). Here, we focus on two potential hegemons, the United States and China, and we assume that only the hegemon can cut off exports. For every country n, we measure the level of power that the hegemon (United States or China) has over the country in equation (18). In our baseline empirical implementation, we start by considering punishments of cutting off all inputs from firms based in the hegemon country and abstracting from threats using other foreign firms. Including punishments that involve firms in third party countries would add to measured power and would be a valuable next step.

To implement our measure, we use goods trade data from BACI, based on UN Comtrade data. In this case, we match each elasticity at the HS06 level to an ISIC rev. 3 industry code, and then match ITPD-E industries to the ISIC level. We use elasticities of substitution based on tariff changes from Fontagné et al. (2022). These are estimated based on tariff rates at the HS06 level. These cover the universe of manufacturing exports, but do not include estimates for some primary products or services. We assume that the elasticity of substituion within ITPD-E industry is the mean elasticity of substitution of the HS06/ISIC matched to that industry. For financial services trade, we use the OECD-WTO Balanced Trade in Services (BaTIS) dataset.

One crucial challenge with implementing this measure is how to include the role of finance and services trade more generally. As discussed in the previous section, the dollar and the American financial system play a prominent role in American geoeconomic policy, most prominently in sanctions policy. Therefore, we aim to include it in our measure of geoeconomic power. Many of the sectors where the US has the largest trade surplus or simply the largest amount of exports are service sectors. In particular, the United States is a particularly large exporter of financial services. Of course, it is well known that it is challenging to measure service exports (Francois and Hoekman

[26]For these to be in welfare relevant units (profits), we would need $\frac{\beta}{1-\beta} \approx 1$. In order to put our estimates in more meaningful units, we could measure the power of a hegemon over a country n relative to a base country, and therefore only need information on the final three components of Equation 17.

[27]This notion corresponds more closely to "micro-power" in Clayton et al. (2023).

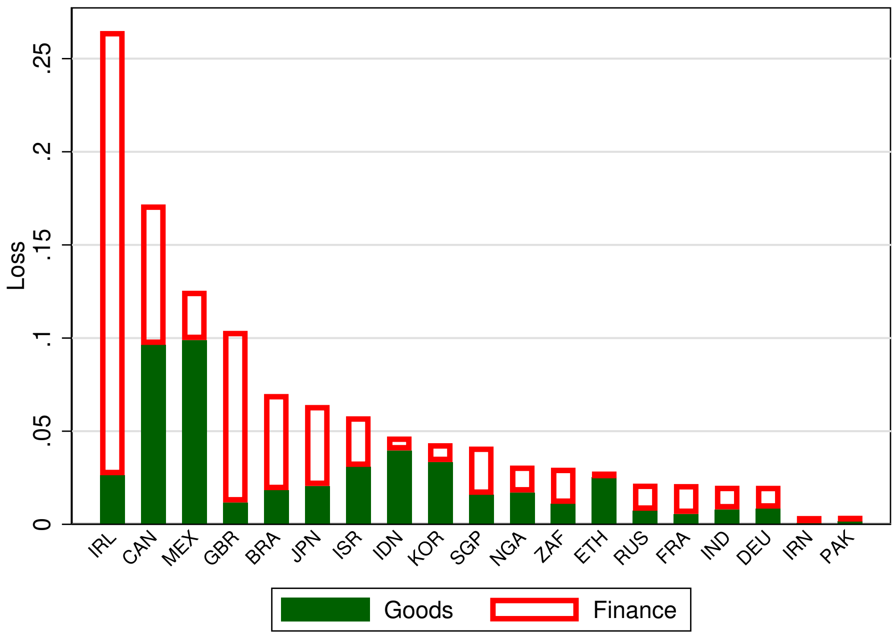
(2010)) and production of the financial sector in particular (Wang and Basu (2008), Basu et al. (2011), and Philippon (2015)). In addition, there is significant heterogeneity in the measurement quality of financial services trade. For instance, much of the measures of Chinese financial services exports rely on mirror data whereas the United States does not. Most importantly, measured financial services exports do not account for the amount of borrowing and lending cross-border, but rather the value-added from finance, frequently imputed at the net interest margin. In this case, lending at a reference rate should generate no production or export of financial services (Wang and Basu (2008)). Of course, given the massive gross asset positions of the United States and the large net asset positions of China, this will have a major effect on our estimates of power. While China is a net lender and this measure will potentially understate its power by not accounting for this fact (because only the value-added component is included in exports), there is significant reason to believe this also understates the power the US derives from finance relative to goods. With these challenges in mind, as a starting point, we treat financial services perfectly symmetrically with goods trade, however in ongoing work we are working to integrate the power coming from gross and net lending positions, as well as other forms of service trade.

To include trade in financial services in our measure of power, we begin by following the calibration in Pellegrino et al. (2021). Pellegrino et al. (2021) calibrates the elasticity of substitution between different countries' assets at 1.3 based on the demand system estimates of Koijen and Yogo (2020).[28] Our measure of financial services includes both "Financial Services" and "Insurance and Pensions" from the BaTIS dataset. However, it is important to note that these estimated elasticities of substitution across financial assets of various countries were not designed to measure the elasticity of substitution of financial service provision across countries.

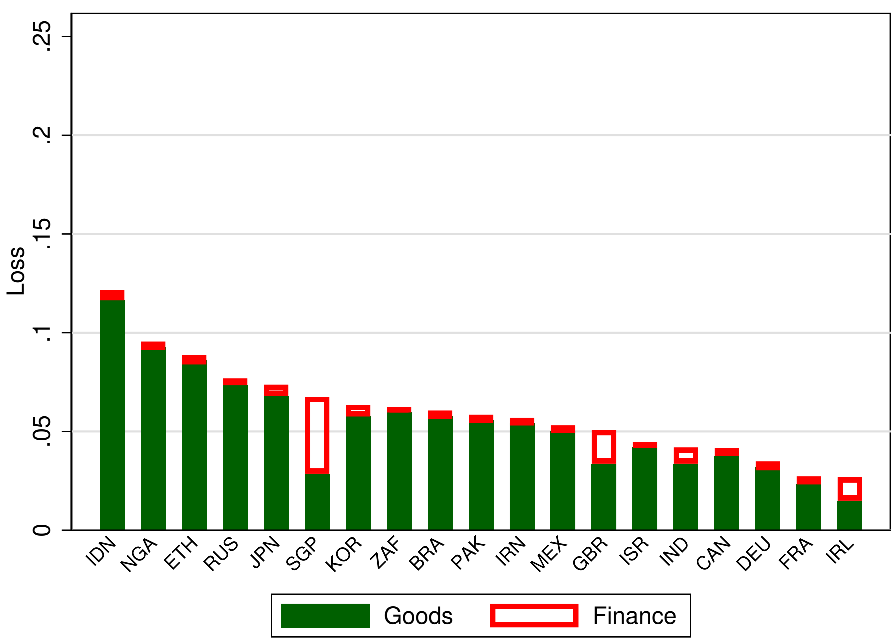
Empirical Measure In Figure 5, we plot our measure of American and Chinese power over countries around the world for 2021. As expected, the United States and China have more power over countries relatively close to them, with the US displaying a large amount of power over Canada and Mexico and China possessing a large amount of power over South Korea. We also see the United States displaying a large amount of financial power over Ireland. While the presence of U.S. multinationals in Ireland likely does mean some of this power is real, it also highlights the challenge of measuring financial exports as Ireland is an important offshore financial center, conflating the measurement. Even with this important caveat, however, the difference with the sources of China's power is clear. The overwhelming share of Chinese power arises from goods trade, with financial power only playing a significant role in Singapore and the United Kingdom (with much of that arising from Hong Kong, which we aggregate to China as part of this exercise).

[28] Table 3.1 of "International Transactions, International Services, and International Investment Position Tables" on "U.S. International Services Trade" from the Bureau of Economic Analysis reports that the bulk of exports of Financial services are accounted for by "Financial Management Services", "Credit card and other credit-related services", and "Securities lending, electronic funds transfer, and other services". Given the high degree of customization in these services, there is reason to calibrate the elasticity towards the lower end.

Figure 5: **American and Chinese Geoeconomic Power, 2021**



(a) United States

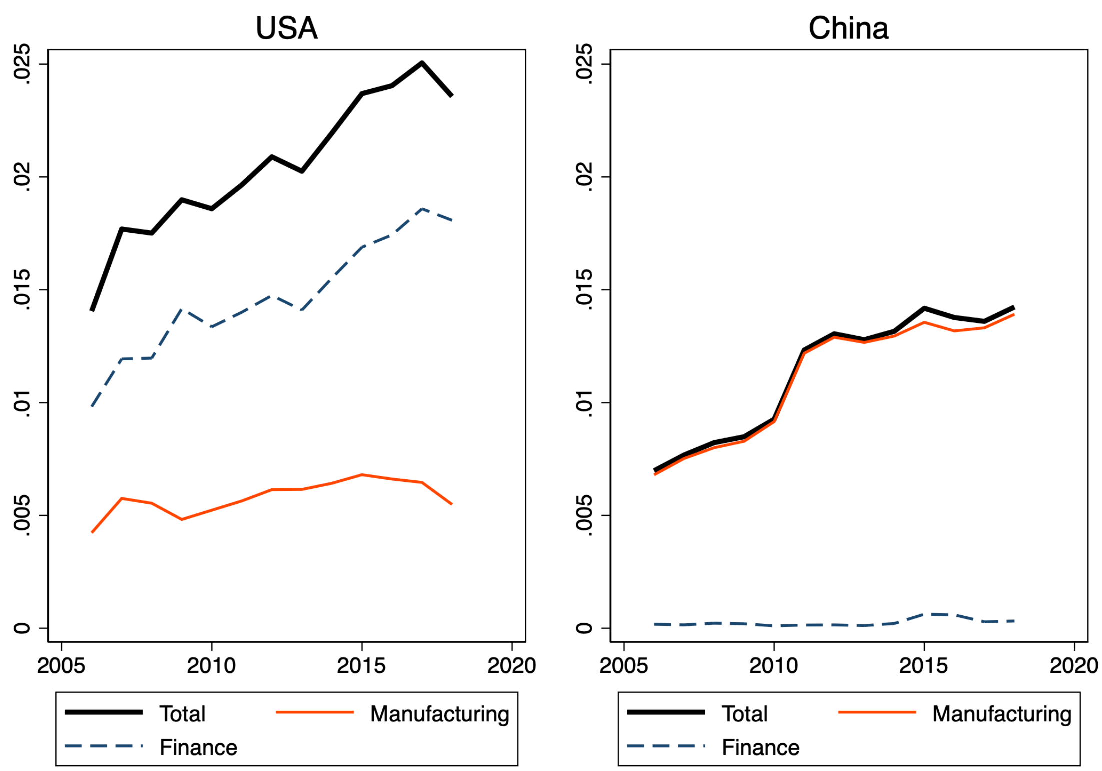


(b) China

Notes: The figure plots estimates of the power as in equation (18). Goods trade data from BACI, service data from the OECD-WTO BaTIS dataset, and elasticities are from Fontagné et al. (2022).

In Figure 6, we construct an aggregate measure of US and Chinese power, weighting countries by their economic size. Importantly, we split total power over the rest of the world (excluding the power the US and China have over each other) into the part coming from manufacturing trade and that coming from finance.[29] If we were to only measure American and Chinese power using the goods trade data and the corresponding elasticities, then it would appear that China has far surpassed the United States in terms of geoeconomic power. However, we see that China has very limited financial power, whereas finance accounts for roughly 75% of American power in recent years. While this figure was constructed to be consistent with the Balance of Payments and so Mainland China and Hong Kong are treated as distinct entities, if we were to consider Hong Kong's exports of financial services as part of China's power, then China would have significantly more measured financial power. However, the conclusion that finance is a disproportionately important source of American power relative to manufacturing in China would not change.

Figure 6: US and Chinese Power: Manufacturing and Finance



Notes: This figure plots the power calculation in Equation 18, aggregated to the global level weighted by country size. China and the United States are dropped as target countries for this calculation.

This conclusion is dependent on our calibrated elasticity for financial services. In Appendix

[29] We begin our measure in 2006 when the data on service trade becomes more complete.

Figure A.1, we quantify this point, varying the assumed elasticity of substitution within finance from 1.2, 1.3 (our baseline), 2, 5, 10, and 20. As we move away from low elasticities, we estimate a sharp drop in measured U.S. power. This highlights the need for direct estimation of the elasticity of substitution of financial services, as well as service exports more generally, in order to more credibly pin down the relative power of hegemons over time and across countries. At present it is unclear the connection between measured bilateral financial service exports in official trade data and the actual cost to countries of losing access. For instance, it is quite possible that settlements and clearing of dollar payment contribute very little to measured financial services exports compared to asset management fees, even if they would be far more costly to lose access to.

5.2 Gravity and Geoeconomic Alignment

In this section, we demonstrate that our framework with CES production generates a gravity structure of trade where the wedges imposed by individual countries and the hegemon generate endogenous deviations from standard gravity predictions. We then explore how this structural gravity equation can be used to empirically infer changes in geoeconomic preferences and derive testable predictions of our theory. Finally, we demonstrate how an extended version of the gravity equation might be used in order to infer macro-strategic industries, and to identify instances where changes in global trade flows are evidence of fragmentation.

As in the prior subsection, we denote the world industry types by $J \in \mathcal{J}$ (e.g., semiconductors), with $j = (J, n)$ denoting industry J located in country n (e.g., semiconductors in the U.S.). Therefore, x_{ij} for $i = (I, n)$ and $j = (J, o)$ indicates that a firm in industry I in country n buys from industry J in country o. We assume that production by firm i takes a nested form,

$$f_i(x_i) = f_i(\{X_{iJ}\}), \quad X_{iJ} = \left(\sum_n \alpha_{iJn} x_{iJn}^{\frac{\sigma_J - 1}{\sigma_J}} \right)^{\frac{\sigma_J}{\sigma_J - 1}}$$

where σ_J is the elasticity of substitution of goods produced by different countries within industry J. The outer nest (i.e. the production function f_i combining these aggregate varieties X_{iJ} into the good produced by firm i) does not need to be specified but can take standard forms such as Cobb-Douglas or CES.

We begin with the following result that characterizes a gravity equation for x_{iJn} from the total ad valorem wedge $\bar{t}_{ijN} = \frac{\bar{\tau}_{iJn}}{p_{Jn}}$ inserted into its decision problem (potentially by both its domestic government and the hegemon).

Proposition 11 *Purchases x_{iJn} by firm i of the industry-J goods produced in country n satisfy*

$$\log x_{iJn} = \gamma_{iJ} + \gamma_{Jn} + \sigma_J \log \alpha_{iJn} - \sigma_J \log(1 + \bar{t}_{iJn}) \tag{19}$$

where $\gamma_{iJ} = \log X_{iJ} - \sigma_J \log P_{iJ}$ and where $\gamma_{Jn} = -\sigma_J \log p_{Jn}$.

While γ_{iJ} and γ_{Jn} depend on several underlying parameters, they are standard multilateral resistance terms in gravity regressions and subsumed by fixed effects (Anderson and Van Wincoop (2003)). Below, we implement these regressions at the source-industry and destination-industry level given that we are using sectoral trade data.

5.2.1 Geopolitical Utility Spillovers in the Non-cooperative Equilibrium

In order to take the model to the data, we need to characterize the wedges imposed by countries around the world. We begin with the non-cooperative equilibrium without a hegemon. We consider a simple variant in which there are utility spillovers from bilateral trades. To obtain concrete tax formulas, we assume constant prices (Definition 1). The utility spillover to country n is given by

$$u_n(z) = \theta \sum_{i \in \mathcal{I}} \sum_{J \in \mathcal{J}} \epsilon_J \left[\sum_{n'} \zeta_{nn'} \; p_{Jn'} \; z_{iJn'} \right].$$

The parameter $\theta \geq 0$ captures the magnitude of the utility spillover perceived by country n. $\epsilon_J \geq 0$ captures the importance of industry J from a geopolitical perspective. The parameter $\zeta_{nn'}$ captures the geopolitical alignment between countries n and n', with $\zeta_{nn'} > 0$ indicating geopolitically aligned countries and $\zeta_{nn'} < 0$ indicating non-aligned countries. This means that every country around the world receives a direct utility spillover from purchasing intermediate inputs as a function of how geopolitically aligned it is with the country it is trading with (as well as from all other global bilateral input purchases). These externalities increase linearly with the amount spent on a good.

In this setup, the (ad-valorem) optimal tax formula of country n in the non-cooperative equilibrium without a hegemon is given by

$$t_{n,iJn'} = -\theta \epsilon_J \zeta_{nn'}.$$

Thus country n imposes a larger tax/subsidy when geopolitical spillovers are larger (θ higher), when industry J is geopolitically important (ϵ_J large), and when country n is more strongly aligned or misaligned with country n' ($\zeta_{nn'}$ larger).

Specializing Proposition 11 to this example and letting $\log(1 + \bar{t}_{iJn}) \approx \bar{t}_{iJn}$, we have

$$\log x_{iJn'} \approx \gamma_{iJ} + \gamma_{Jn'} + \sigma_J \log \alpha_{iJn'} + \theta \sigma_J \epsilon_J \zeta_{nn'}. \tag{20}$$

Consider therefore predicting trade patterns $\log x_{iJn'}$ using alignment $\zeta_{nn'}$. Equation (20) suggests that a higher magnitude coefficient on alignment arises across industries when countries place more weight on geopolitical considerations (higher θ). It also predicts that industries with a higher elasticity of substitution across countries (higher σ_J) or higher geopolitical importance (higher ϵ_J) should have higher magnitude coefficients.

We begin by taking this to the data by exploring whether the weight that countries place on geopolitical closeness has changed relative to the weight that they put on other determinants of trade, before turning to industry heterogeneity. We run a series of regressions of the form

$$x_{iJn't} = \exp(\gamma_{iJt} + \gamma_{Jn't} + \sigma_{Jt} \log \alpha_{iJn'} + \theta_t \zeta_{nn't})\epsilon_{iJn't}. \tag{21}$$

We measure bilateral trade flows at the industry level using the BACI trade dataset, based on UN Comtrade data covering 2012-2022 based on the HS12 industry code. We then aggregate the industry data to the ISIC3 level for our regression specification. The advantage of the BACI data is that it lets us take the analysis through 2022 as opposed to the ITPD data that ends in 2019. Given our emphasis on fragmentation, and exploring its rise in recent years, this is an important benefit of BACI. There are two disadvantages of the BACI dataset: it is missing domestic trade and it does not include financial services trade. To measure the geopolitical distance $\zeta_{nn't}$, we use UN Voting Agreement from Bailey et al. (2017). We estimate the regression as a repeated cross-section, allowing for source-industry-time and destination-industry-time fixed effects. We estimate the regressions using Pseudo-Poisson Maximum Likelihood (Silva and Tenreyro (2006)) using the package developed by Correia et al. (2020).[30] For the gravity variables $\alpha_{iJn'}$, we use the CEPII Gravity database (Conte et al. (2022)) and include the log of geographic distance and a dummy for contiguity.

In Figure 7, we plot the time variation in the estimated weight countries put on geopolitical distance, θ_t, along with two standard error bands. We find that it is only in 2022 that this measure increases and is significantly different than zero. Through the context of the model, we interpret this as evidence that the weight governments are now putting on geopolitical closeness has increased. Table 1 reports the full regression results for 2013, 2016, 2019, and 2022.[31]

The model's gravity structure in equation (20) also provides a clear prediction on heterogeneity by industry. In particular, given our specification of geopolitical externalities that countries prefer to source goods from countries geopolitically closer to them, governments should seek to divert their trade away from their geopolitical adversaries more in industries in which it is least costly to do so. In the context of the model, that is industries with a higher elasticity of substitution, where the production distortions from following these geopolitical preferences should be smallest. We now turn to exploring heterogeneity in the relationship between geopolitical closeness and the elasticity of substitution of goods within an industry. To do so, we run regressions of the form

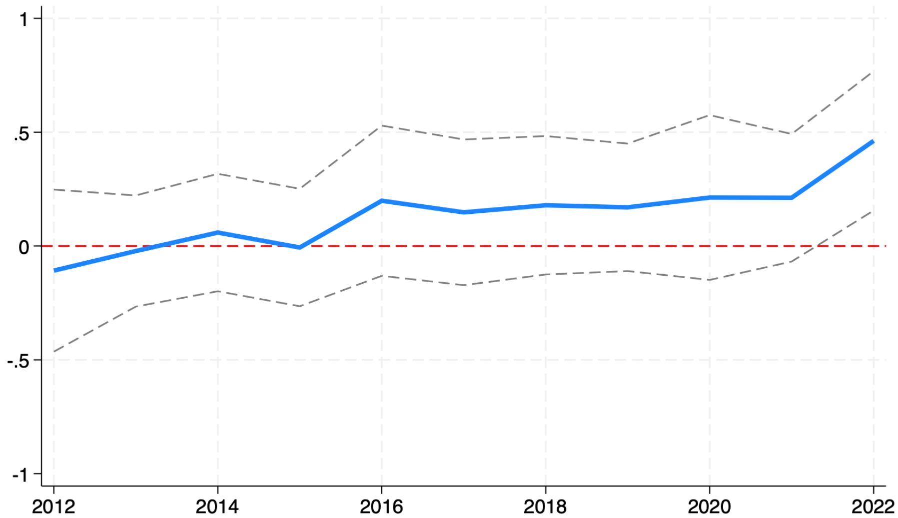
$$x_{iJn'} = \exp(\gamma_{iJ} + \gamma_{Jn'} + \sigma_J \log \alpha_{iJn'} + \theta_J \zeta_{nn'})\epsilon_{iJn'}. \tag{22}$$

where now we allow the coefficient θ to vary by industry. We then explore whether geopolitics plays a larger role in explaining trade flows the higher is the elasticity of substitution by trying to explain

[30] Given the high dimensionality of the data, we do not populate the zeros in the BACI data.

[31] While a similar increase in the weight put on geopolitical closeness can be seen in a gravity regression on aggregate trade flows, in the early part of the sample, we would actually find that $\theta_t<0$, indicating geopolitical affinity leads to less trade. By running the regression at the sectoral level with country-industry fixed effects, we remove industrial composition differences.

Figure 7: Time Variation in Geopolitical Weight, θ_t



Notes: This figure reports the estimates of θ from the PPML estimation of equation (21). The solid line is the point estimate and the dashed lines are two standard error bands.

Table 1: Trade and Political Affinity, Select Years

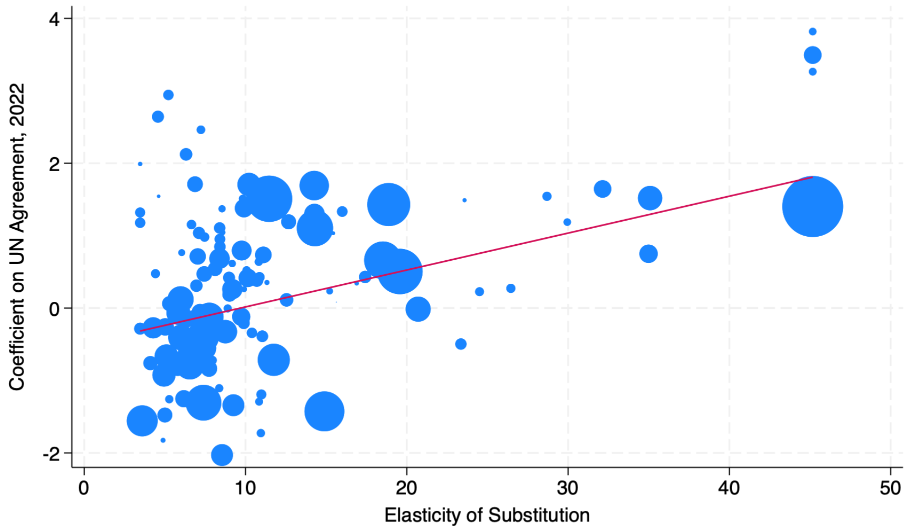
	(1) 2013	(2) 2016	(3) 2019	(4) 2022
UN Agreement	-0.0220	0.199	0.170	0.462***
	(0.122)	(0.165)	(0.140)	(0.153)
Log(Distance)	-0.813***	-0.766***	-0.770***	-0.744***
	(0.0261)	(0.0249)	(0.0259)	(0.0279)
Contiguity	0.576***	0.574***	0.539***	0.550***
	(0.0541)	(0.0544)	(0.0544)	(0.0630)
Exporter × Industry FE	Yes	Yes	Yes	Yes
Importer × Industry FE	Yes	Yes	Yes	Yes
Observations	968,934	1,084,394	1,130,290	1,074,208

Notes: The table reports regression results from equation 21, estimating using the package of Correia et al. (2020).

the industry heterogeneity in the estimated θ's by the elasticity of substitution of the industries.

Figure 8 plots the results. Each dot is the estimated θ in a sector-specific gravity regression in 2022, with the size of the dot corresponding to the size of industry global exports. We then sort these estimates by the elasticity of substitution from Fontagné et al. (2022), aggregated to the ISIC3 level. While Figure 8 visually confirms the strong positive relationship implied by the model, Table 2 explores the relationship more formally. In particular, it runs a regression of the form $\theta_J = \alpha + \beta\sigma_J + \epsilon_J$. Column 1 runs this regression on the raw data, column 2 weights the observations

Figure 8: Geopolitical Closeness and the Elasticity of Substitution, 2022



Notes: This plots the estimated θ (y-axis) from estimating equation 22 in 2022 against the elasticity of substitution from Fontagné et al. (2022) aggregated to the ISIC level.

by industry size, and column 3 weights by size and only considers elasticities of substitution less than 20. In all specifications, we find a positive relationship between the importance of geopolitical closeness and the elasticity of substitution.[32] Indeed, this simple uni-variate regression can explain nearly 30% of the variation in industry heterogeneity in the importance of geopolitics.

Table 2: **Geopolitical Closeness and the Elasticity of Substitution, 2022**

	(1)	(2)	(3)
σ_J	0.0360***	0.0377***	0.0963***
	(0.00828)	(0.00772)	(0.0262)
Constant	-0.156	-0.341*	-0.926***
	(0.128)	(0.190)	(0.236)
Observations	138	138	123
R-squared	0.186	0.278	0.207
Weighted	No	Yes	Yes
σ<20	No	No	Yes

Notes: The reports regression coefficients from $\theta_J = \alpha + \beta\sigma_J + \epsilon_J$, where θ (y-axis) are from estimating equation 22 in 2022 against the elasticity of substitution from Fontagné et al. (2022) aggregated to the ISIC level.

[32] The standard errors do not account for the fact that our $\hat{\theta}$ are generated regressors and need to be further adjusted for this.

5.2.2 Gravity and Macro-Power

We conclude this section by discussing how future work could use the gravity structure generated by this framework to identify and measure the application of power by the hegemon to shape global trade flows between third party countries. The power consider so far is what Clayton et al. (2023) call "micro-power". It measures the private cost of actions a hegemon can ask firms to undertake that leaves the firms indifferent to accepting the hegemon's offer or rejecting it. This, however, does not measure the value to the hegemon of these costly actions undertaken by a firm, what we refer to as "macro-power." In particular, it is possible that an action is not very costly privately to a targeted firm but can generate large gains for the hegemon because of its propagation through the structure of the global input-output network. In such a case, we would observe a large divergence between micro and macro power.

To make progress on measuring such macro power, we consider geopolitical utility spillovers in the hegemon's equilibrium (Proposition 1). We consider the same utility spillovers in the problem with the hegemon,

$$u_m(z) = \theta \sum_{i \in \mathcal{I}} \sum_{j \in \mathcal{J}} \epsilon_J \left[\sum_n \zeta_{mn} \; p_{Jn} \; z_{iJn} \right],$$

but abstract from anti-coercion. With these preferences, the hegemon's tax on a firm in its contracting set is

$$t_{m,iJn} = -\frac{1}{1+\eta_i} \theta \epsilon_J \zeta_{mn},$$

which means that the hegemon imposes a tax on its adversaries ($t_{m,iJn} > 0$ if $\zeta_{mn} < 0$) and a subsidy on its allies ($t_{m,iJn} < 0$ if $\zeta_{mn} > 0$). Specializing Proposition 11, we have

$$\log x_{iJn} \approx \gamma_{iJ} + \gamma_{Jn} + \sigma_J \log \alpha_{iJn} + \theta \sigma_J \epsilon_J \frac{1}{1+\eta_i} \zeta_{mn}. \tag{23}$$

While equation (23) fits a structural gravity set-up, crucially the final term is no longer dependent on the bilateral relationship between importers and exporters i and n, but rather depends on the triple between i, n and the hegemon m. In particular, the measure of geopolitical closeness is now that between the hegemon and the exporter n. This geopolitical closeness is interacted with $\frac{1}{1+\eta_i}$, which measures the marginal value of power the hegemon m has over sector i. While the hegemon's geopolitical preferences θ and the elasticity of substitution σ_J enter as before, we also allow for the possibility that the hegemon's desire to shift the equilibrium can vary by industry, ϵ_J. This can be because some industries are direct inputs into military power, or indirectly so (i.e. semiconductors).

While we have not yet taken this equation to the data, it offers a guide for future empirical work in the area. In particular, if we were to measure $\frac{1}{1+\eta_i}$ through the degree of power a hegemon has over industry i and continue to measure geopolitical closeness with UN voting alignment, but assuming θ is constant across industries within time, then we have the hope of inferring which industries the hegemon has been targeting the most ϵ_J. This opens the possibility of measuring which industries are therefore macro-strategic, as this would be where the hegemon uses its limited power to shape the global equilibrium.

6 Conclusion

Geoeconomic tensions have been on the rise given political shifts in the US, the rise of China as a great economic power, and changes in technology. These tensions have the potential to fragment the world trade and financial system, unwinding gains from international integration. A number of countries are introducing mixes of industrial, trade, and financial policies to insulate their economies from unwanted foreign influence. Collectively these policies come under the umbrella of anti-coercion tools. We provide a simple model to jointly analyze economic coercion by a hegemon and anti-coercion policies by the rest of the world. We show that precisely those forces, like economies of scale, that are traditional rationales for global integration and specialization can be used by a hegemon to increase its coercive power. The rest of the world countries react by implementing anti-coercion policies that shift their domestic firms away from the hegemon global inputs into an inefficient home alternative. We show that uncoordinated anti-coercion policy results in inefficient fragmentation as each country over-insulates its economy. We study the financial services industry, e.g. global payments and settlement systems, as an industry with strong strategic complementarities at the global level. The US uses its dominance in these financial services as a tool of coercion. China and Russia have resorted to using inefficient home alternatives to insulate their economies from possible US pressure.

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Online Appendix for "A Theory of Economic Coercion and Fragmentation"

Christopher Clayton Matteo Maggiori Jesse Schreger

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A.1 Economic Security and Anti-Coercion Policy

Several governments have recently put forward Economic Security Strategy initiatives aimed at derisking their economies from foreign dependencies. We briefly review here some of the most high profile policy initiatives.

The G7 governments statement in 2023 on Economic Resilience and Economic Security provided an overview of shared concerns about economic coercion. It remarked: "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 work together to ensure that attempts to weaponize economic dependencies by forcing G7 members and our partners including small economies to comply and conform will fail and face consequences." Several countries have subsequently followed up with their own policy initiatives.

Japan. Japan was one of the first advanced economies to adopt formal economic security policies. Its Economic Security Protection Act (ESPA) aims to: (1) "Ensure stable supplies of critical products" through diversification and stockpiling; (2) "Ensure stable provision of essential infrastructure services" and prevent disruptions by foreign entities; (3) "Support for development of critical technologies"; and (4) Establish a non-disclosure system for patents related to sensitive technologies.[1]

European Union. The EU introduced its economic security framework in June 2023. This framework focuses on evaluating threats to economic security such as identifying critical materials and technologies,[2] and institutions to address those risks, including Single Intelligence Analysis Capacity (SIAC) for detecting threats, Strategic Technologies for Europe Platform (STEP) for supporting R&D in critical technology, Common Foreign and Security Policy (CFSP) for enhancing cyber and digital security, and Coordination Platform on Economic Coercion (CPEC) for addressing non-market or coercive practices. Based on the framework, the European Commission adopted five initiatives in January 2024 (see press release), aiming at strengthening FDI screening, monitoring outbound investments, controlling export of dual-use goods, supporting R&D in dual-use technologies, and enhancing research security.

United Kingdom. The UK has also implemented measures to support strategic sectors and ensure economic security. Through energy support packages and plans to increase annual R&D budget, the UK is investing in strategic sectors such as energy, artificial intelligence, and cybersecurity (See the Integrated Review Refresh of 2023). Legislation is also in place to maintain the country's control over strategic sectors, for example the National Security and Investment Act that

[1] See also a summary of the Japanese policies provided by the European Parliament.

[2] In October 2023, the European Commission recommended to consider advanced semiconductors, artificial intelligence, quantum technologies and biotechnologies as critical technologies. See press release.

"gives the government powers to scrutinise and intervene in business transactions, such as takeovers, to protect national security".[3]

Australia Australia is also advancing policies to support sectors in which "some level of domestic capability is a necessary or efficient way to protect the economic resilience and security of Australia, and the private sector will not deliver the necessary investment in the absence of government support" (see Future Made in Australia initiative). The Australian government highlights the country's advantage in minerals and energy resources, and propose to develop these industries into strategic sectors that contributes to global economic security by serving as a reliable supplier of natural resources.

South Korea. In October 2022, South Korea announced the National Strategic Technology Nurture Plan "to foster strategic technologies that will contribute to future society and national security in the global tech competition era where new and core technologies determine the fate of national economy, security, and diplomacy." The plan identifies twelve key sectors, including semiconductor, energy, cybersecurity, AI, communication, and quantum, as national strategic technologies. These sectors "will be regularly evaluated and improved in consideration of technology development trends, technology security circumstances, and policy demands."

A.2 Proofs

A.2.1 Proof of Lemma 1

Consider a hypothetical optimal contract Γ that is feasible and satisfies firms' participation constraints, and suppose that $\mathcal{J}_i' \neq \underline{\mathcal{J}_i}'$. Let (x^*, ℓ^*, z^*, P) denote optimal firm allocations, externalities, and prices under this contract. The proof strategy is to show that the hegemon can achieve the same allocations x^*, ℓ^* and the same transfers T_i using a feasible contract featuring maximal punishments threats, without changes in equilibrium prices or the vector of aggregates. Hence the hegemon can obtain at least as high value using maximal punishments. The proof involves constructing appropriate wedges to achieve this outcome.

We first construct a vector of taxes $\tau^*_{m,i}$ that implements the allocation x^*_i, ℓ^*_i under maximal punishments for each $i \in \mathcal{D}_m$. In particular, let $\tau^{x*}_{m,ij} = \frac{\partial \Pi_i(x^*_i, \ell^*_i)}{\partial x_{ij}} - \tau^x_{n,ij}$ and $\tau^{\ell*}_{if} = \frac{\partial \Pi_i(x^*_i, \ell^*_i)}{\partial \ell_{if}} - \tau^\ell_{n,ij}$, then because firm i's optimization problem is convex, this implements the allocation (x^*_i, ℓ^*_i). Finally, every firm $i \notin \mathcal{D}_m$ and every consumer n faces the same decision problem as under the original contract, since both prices and the vector of aggregates are unchanged. Hence, every firm $i \notin \mathcal{D}_m$ and every consumer n has the same optimal policy. Hence $x^* = z^*$ and aggregates are consistent with their conjectured value. Finally, market clearing remains satisfied since all allocations are unchanged.

Finally, given firm i's participation constraint was satisfied under the originally contract, it is also satisfied under the new contract since firm value is the same given the same allocations, transfers, prices, and aggregates. Finally since firm value is unchanged for $i \in \mathcal{I}_m$, since prices P and aggregates z^* are unchanged, and since transfers T_i are unchanged for all $i \in \mathcal{D}_m$, the hegemon's objective (equation 4) is also unchanged relative to the original contract. Thus the hegemon is indifferent between the implementable contracts $\{\mathcal{S}_i', \mathcal{T}_i, \tau_i\}_{i \in \mathcal{C}_m}$ and $\{\overline{\mathcal{S}}_i', \mathcal{T}_i, \tau^*_i\}_{i \in \mathcal{C}_m}$.

[3] See also additional strategies like the Critical Minerals Strategy, the National Semiconductor Strategy, and the UK Critical Imports and Supply Chains Strategy.

Hence, it is weakly optimal for the hegemon to offer a contract involving maximal punishments, concluding the proof.

A.2.2 Proof of Lemma 2

Suppose by way of contradiction that the participation constraint of firm $i \in \mathcal{C}_m$ did not bind. We conjecture and verify that the same equilibrium prices P and aggregate quantities $z*$ can be sustained while increasing T_i. Under the conjecture that prices and aggregates do not change, firm and consumer optimization do not change, and therefore all factor markets clear. It remains only to verify thta goods markets still clear. Market clearing for good i is given by

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

Given homothetic preferences, we can define the expenditures of consumer n as

$$C_{nj}(p) = c_j(p) w_n$$

and, therefore, aggregate consumption is given by

$$\sum_{n=1}^{N} C_{nj}(p, w_n) = \sum_{n=1}^{N} c_j(p) w_n = c_j(p) \sum_{n=1}^{N} w_n$$

Therefore, an increase in T_i holds fixed aggregate wealth, and hence markets still clear. Thus we have found a feasible perturbation that is welfare improving, contradicting that the participation constraint did not bind and concluding the proof.

A.2.3 Proof of Proposition 1

The hegemon's problem is to choose τ_m to maximize

$$\mathcal{U}_m = W_m\left(p, \sum_{i \in \mathcal{I}_m} V_i(\mathcal{J}_i) + \sum_{f \in \mathcal{F}_m} p_f^{\ell} \bar{\ell}_f + \sum_{i \in C_m} \left(V_i(\tau_m, \mathcal{J}_i) - V_i^o(\underline{\mathcal{J}}_i) - G_i\right)\right) + u_m(z)$$

subject to the non-negativity constraint on transfers,

$$V_i(\tau_m, \mathcal{J}_i) - V_i^o(\underline{\mathcal{J}}_i) - G_i \geq 0.$$

We can re-represent the hegemon's problem under the primal approach of choosing allocations $\{x_i, \ell_i\}_{i \in \mathcal{C}_m}$. Under the primal approach, we can write the Lagrangian of the hegemon

$$\begin{aligned}\mathcal{L}_m =& W_m\left(p, \sum_{i \in \mathcal{I}_m} V_i(\mathcal{J}_i) + \sum_{f \in \mathcal{F}_m} p_f^{\ell} \bar{\ell}_f + \sum_{i \in C_m} \left(\Pi_i(x_i, \ell_i, \mathcal{J}_i) - \tau_{n,i}^x x_i - \tau_{n,i}^{\ell} \ell_i + r_{n,i}^* - V_i^o(\underline{\mathcal{J}}_i) - G_i\right)\right) + u_m(z) \\ &+ \sum_{i \in \mathcal{C}_m} \eta_i \left[\Pi_i(x_i, \ell_i, \mathcal{J}_i) - \tau_{n,i}^x x_i - \tau_{n,i}^{\ell} \ell_i + r_{n,i}^* - V_i^o(\underline{\mathcal{J}}_i) - G_i\right]\end{aligned}$$

The hegemon's first order condition for x_{ij}, $i \in \mathcal{C}_m$, is given by

$$0 = \frac{\partial \mathcal{L}_m}{\partial x_{ij}} + \frac{\partial \mathcal{L}_m}{\partial z} \frac{dz}{dx_{ij}} + \frac{\partial \mathcal{L}_m}{\partial P} \frac{dP}{dx_{ij}}.$$

We derive each component. We can then trace it back to the end optimal tax formula, noting that the firm's first order conditions imply implementing wedges

$$\tau^x_{m,ij} = \frac{\partial \Pi_i}{\partial x_{ij}} - \tau^x_{n,ij}$$

$$\tau^\ell_{m,if} = \frac{\partial \Pi_i}{\partial \ell_{if}} - \tau^\ell_{n,if}$$

Direct effect. First, we have the direct effect,

$$\frac{\partial \mathcal{L}_m}{\partial x_{ij}} = \left(\frac{\partial W_m}{\partial w_m} + \eta_i \right) \left(\frac{\partial \Pi_i}{\partial x_{ij}} - \tau^x_{n,ij} \right)$$

Thus substituting in the firm's FOCs, we have

$$\frac{\partial \mathcal{L}_m}{\partial x_{ij}} = \left(\frac{\partial W_m}{\partial w_m} + \eta_i \right) \tau^x_{m,ij}$$

Indirect Effect of z. We have

$$\frac{\partial \mathcal{L}_m}{\partial z} = \frac{\partial W_m}{\partial w_m} \sum_{i \in \mathcal{I}_m} \frac{\partial V_i(\mathcal{J}_i)}{\partial z} + \sum_{i \in \mathcal{C}_m} \left(\frac{\partial W_m}{\partial w_m} + \eta_i \right) \left(\frac{\partial \Pi_i(x_i, \ell_i, \mathcal{J}_i)}{\partial z} - \frac{\partial V_i^o(\underline{\mathcal{J}}_i)}{\partial z} \right) + \frac{\partial u_m}{\partial z}$$

From here, we can write out for any domestic firm $i \in \mathcal{I}_m$

$$\frac{\partial V_i(\mathcal{J}_i)}{\partial z} = \frac{\partial \Pi_i}{\partial z} + \frac{\partial \Pi_i}{\partial \mathbf{x}_i} \frac{\partial X_i}{\partial z} = \frac{\partial V_i(\mathcal{J}_i)}{\partial z} = \frac{\partial \Pi_i}{\partial z} + \tau_{m,i} \frac{\partial \mathbf{x}_i}{\partial z}$$

and for any foreign firm $i \in \mathcal{C}_m$,

$$\frac{\partial V_i^o(\underline{\mathcal{J}}_i)}{\partial z} = \frac{\partial \Pi_i^o}{\partial z} + \left(\frac{\partial \Pi_i^o}{\partial \mathbf{x}_i} - \tau_{n,i} \right) \frac{\partial \mathbf{x}_i}{\partial z} = \frac{\partial \Pi_i^o}{\partial z},$$

which follows by Envelope Theorem and since revenue remissions are taken as given. Therefore, we can write

$$\frac{\partial \mathcal{L}_m}{\partial z} = \frac{\partial W_m}{\partial w_m} \sum_{i \in \mathcal{I}_m} \left(\frac{\partial \Pi_i}{\partial z} + \tau_{m,i} \frac{\partial \mathbf{x}_i}{\partial z} \right) + \sum_{i \in \mathcal{C}_m} \left(\frac{\partial W_m}{\partial w_m} + \eta_i \right) \left(\frac{\partial \Pi_i}{\partial z} - \frac{\partial \Pi_i^o}{\partial z} \right) + \frac{\partial u_m}{\partial z}$$

Indirect Effect of P. We have

$$\frac{\partial \mathcal{L}}{\partial P} = \frac{\partial W_m}{\partial P} + \frac{\partial W_m}{\partial w_m} \left(\sum_{i \in \mathcal{I}_m} \frac{\partial V_i(\mathcal{J}_i)}{\partial P} + \sum_{f \in \mathcal{F}_m} \frac{\partial p_f^\ell}{\partial P} \bar{\ell}_f \right) + \sum_{i \in \mathcal{C}_m} \left(\frac{\partial W_m}{\partial w_m} + \eta_i \right) \left(\frac{\partial \Pi_i}{\partial P} - \frac{\partial V_i^o(\underline{\mathcal{J}}_i)}{\partial P} \right)$$

As above, we have

$$\frac{\partial V_i^o(\underline{\mathcal{J}}_i)}{\partial P} = \frac{\partial \Pi_i^o}{\partial P} + \left(\frac{\partial \Pi_i^o}{\partial \mathbf{x}_i} - \tau_{n,i}\right)\frac{\partial \mathbf{x}_i}{\partial P} = \frac{\partial \Pi_i^o}{\partial P}$$

Next, we can write

$$\frac{\partial W_m}{\partial P} = -\frac{\partial W_m}{\partial w_m}\sum_{i\in\mathcal{I}}\frac{\partial p_i}{\partial P}C_{mi}$$

and similarly

$$\frac{\partial V_i(\mathcal{J}_i)}{\partial P} = \tau_{m,i}\frac{\partial \mathbf{x}_i}{\partial P} + \frac{\partial p_i}{\partial P}y_i - \sum_{j\in\mathcal{J}_i}\frac{\partial p_j}{\partial P}x_{ij} - \sum_{f\in\mathcal{F}_m}\frac{\partial p_f^\ell}{\partial P}\ell_{if}$$

Putting together and using market clearing for domestic factors, we obtain

$$\frac{\partial \mathcal{L}}{\partial P} = \frac{\partial W_m}{\partial w_m}\sum_{i\in\mathcal{I}_m}\tau_{m,i}\frac{\partial \mathbf{x}_i}{\partial P} + \frac{\partial W_m}{\partial w_m}\sum_{i\in\mathcal{I}}\frac{\partial p_i}{\partial P}X_{m,i} + \sum_{i\in\mathcal{C}_m}\left(\frac{\partial W_m}{\partial w_m} + \eta_i\right)\left(\frac{\partial \Pi_i}{\partial P} - \frac{\partial \Pi_i^o}{\partial P}\right)$$

where $X_{m,i} = y_i - \sum_{i\in\mathcal{I}_m} x_{ij} - C_{mi}$. Note the second term is terms of trade manipulation.

Putting it Together. Substituting the direct effect into the FOC, we can write

$$\begin{aligned}\tau_{m,ij}^x = &-\frac{1}{\frac{\partial W_m}{\partial w_m} + \eta_i}\left[\frac{\partial W_m}{\partial w_m}\sum_{i\in\mathcal{I}_m}\left(\frac{\partial \Pi_i}{\partial z} + \tau_{m,i}\frac{\partial \mathbf{x}_i}{\partial z}\right) + \sum_{i\in\mathcal{C}_m}\left(\frac{\partial W_m}{\partial w_m} + \eta_i\right)\left(\frac{\partial \Pi_i}{\partial z} - \frac{\partial \Pi_i^o}{\partial z}\right) + \frac{\partial u_m}{\partial z}\right]\frac{dz}{dx_{ij}} \\ &- \frac{1}{\frac{\partial W_m}{\partial w_m} + \eta_i}\left[\frac{\partial W_m}{\partial w_m}\sum_{i\in\mathcal{I}_m}\tau_{m,i}\frac{\partial \mathbf{x}_i}{\partial P} + \frac{\partial W_m}{\partial w_m}\sum_{i\in\mathcal{I}}\frac{\partial p_i}{\partial P}X_{m,i} + \sum_{i\in\mathcal{C}_m}\left(\frac{\partial W_m}{\partial w_m} + \eta_i\right)\left(\frac{\partial \Pi_i}{\partial P} - \frac{\partial \Pi_i^o}{\partial P}\right)\right]\frac{dP}{dx_{ij}}\end{aligned}$$

We can then regroup terms as:

$$\begin{aligned}\tau_{m,ij}^x = &-\frac{1}{1 + \frac{1}{\frac{\partial W_m}{\partial w_m}}\eta_i}\sum_{i\in\mathcal{I}_m}\tau_{m,i}\frac{d\mathbf{x}_i}{dx_{ij}} \\ &- \frac{1}{1 + \frac{1}{\frac{\partial W_m}{\partial w_m}}\eta_i}\left[\sum_{i\in\mathcal{I}_m}\frac{\partial \Pi_i}{\partial z} + \frac{1}{\frac{\partial W_m}{\partial w_m}}\frac{\partial u_m}{\partial z}\right]\frac{dz}{dx_{ij}} \\ &- \frac{1}{1 + \frac{1}{\frac{\partial W_m}{\partial w_m}}\eta_i}\sum_{i\in\mathcal{I}}X_{m,i}\frac{\partial p_i}{\partial P}\frac{dP}{dx_{ij}} \\ &- \frac{1}{1 + \frac{\partial W_m}{\partial w_m}\eta_i}\sum_{i\in\mathcal{C}_m}\left(1 + \frac{1}{\frac{\partial W_m}{\partial w_m}}\eta_i\right)\left[\left(\frac{\partial \Pi_i}{\partial z} - \frac{\partial \Pi_i^o}{\partial z}\right)\frac{dz}{dx_{ij}} + \left(\frac{\partial \Pi_i}{\partial P} - \frac{\partial \Pi_i^o}{\partial P}\right)\frac{dP}{dx_{ij}}\right]\end{aligned}$$

where $\frac{d\mathbf{x}_i}{dx_{ij}} = \frac{\partial \mathbf{x}_i}{\partial z}\frac{dz}{dx_{ij}} + \frac{\partial \mathbf{x}_i}{\partial P}\frac{dP}{dx_{ij}}$.

Network Amplification The Lemma below is identical to Proposition 2 in Clayton et al. (2023) (see Clayton et al. (2023) for its proof). It shows that the entire propagation can be characterized in terms of a generalized Leontief inverse

Lemma 3 *The aggregate response of z^* and P to a perturbation in ex-post constant e is*

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

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

where $\Psi^z = \left(\mathbb{I} - \frac{\partial x^*}{\partial z^*}\right)^{-1}$ *and* ED *is the vector of excess demand in every good and factor. That is, the* $(|\mathcal{I}| + |\mathcal{F}|) \times 1$ *vector* ED *is* $ED = (ED_1, \dots, ED_{|\mathcal{I}|}, ED_1^\ell, \dots, ED_{|\mathcal{F}|})^T$*, where* $ED_i = \sum_{n=1}^N C_{ni} + \sum_{j \in \mathcal{D}_i} x_{ji} - y_i$ *is excess demand for good* i *and* $ED_f^\ell = \sum_{i \in \mathcal{I}_n} \ell_{if}^* - \bar{\ell}_f$ *is excess demand for market* f*.*

We can then characterize ex post network amplification as follows. For the subset $NC = \mathcal{I} \backslash C_m$ of firms the hegemon does not contract with ex post, we have $\frac{dz^{NC}}{dx_{ij}}$ and $\frac{dP}{dx_{ij}}$ identified by Lemma 3, with the quantities of all firms $i \in \mathcal{C}_m$ held fixed given the primal approach. For the subset of firms $\mathcal{C}_m$, we have $\frac{dz^{\mathcal{C}_m}}{dx_{ij}} = \mathbf{e}_{ij}$, where $\mathbf{e}_{ij}$ is the standard basis vector with a 1 at the location of x_{ij}.

Factor Wedges. The hegemon's first order condition for ℓ_{if}, $i \in \mathcal{C}_m$, is given by

$$0 = \frac{\partial \mathcal{L}_m}{\partial \ell_{if}} + \frac{\partial \mathcal{L}_m}{\partial z}\frac{dz}{d\ell_{if}} + \frac{\partial \mathcal{L}_m}{\partial P}\frac{dP}{d\ell_{if}}.$$

The direct effect is

$$\frac{\partial \mathcal{L}_m}{\partial \ell_{if}} = \left(\frac{\partial W_m}{\partial w_m} + \eta_i\right)\left(\frac{\partial \Pi_i}{\partial \ell_{if}} - \tau_{n,if}^\ell\right).$$

The indirect effects of P and z are the same, so we obtain a parallel equation to that for $\tau_{m,ij}^x$,

$$\begin{aligned}
\tau_{m,if}^\ell = &- \frac{1}{1 + \frac{1}{\frac{\partial W_m}{\partial w_m}}\eta_i}\sum_{i \in \mathcal{I}_m}\tau_{m,i}\frac{d\mathbf{x}_i}{d\ell_{if}} \\
&- \frac{1}{1 + \frac{1}{\frac{\partial W_m}{\partial w_m}}\eta_i}\left[\sum_{i \in \mathcal{I}_m}\frac{\partial \Pi_i}{\partial z} + \frac{1}{\frac{\partial W_m}{\partial w_m}}\frac{\partial u_m}{\partial z}\right]\frac{dz}{d\ell_{if}} \\
&- \frac{1}{1 + \frac{1}{\frac{\partial W_m}{\partial w_m}}\eta_i}\sum_{i \in \mathcal{I}}X_{m,i}\frac{\partial p_i}{\partial P}\frac{dP}{d\ell_{if}} \\
&- \frac{1}{1 + \frac{\partial W_m}{\partial w_m}\eta_i}\sum_{i \in \mathcal{C}_m}\left(1 + \frac{1}{\frac{\partial W_m}{\partial w_m}}\eta_i\right)\left[\left(\frac{\partial \Pi_i}{\partial z} - \frac{\partial \Pi_i^o}{\partial z}\right)\frac{dz}{d\ell_{if}} + \left(\frac{\partial \Pi_i}{\partial P} - \frac{\partial \Pi_i^o}{\partial P}\right)\frac{dP}{d\ell_{if}}\right]
\end{aligned}$$

The network amplification for factors is identical to taht of goods except that $\frac{dz^{\mathcal{C}_m}}{dx_{ij}} = 0$.

A.2.4 Proof of Proposition 2

Consider first the demand of firm i, given by

$$x_{ij}(\tau_m, P, z^*) = z_{ij}^*$$

Totally differentiating in a generic variable e, we have

$$\frac{\partial x_{ij}}{\partial e} + \frac{\partial x_{ij}}{\partial \tau_m}\frac{d\tau_m}{de} + \frac{\partial x_{ij}}{\partial P}\frac{dP}{de} + \frac{\partial x_{ij}}{\partial z^*}\frac{dz^*}{de} = \frac{dz_{ij}^*}{de}.$$

Stacking the system vertically across goods j and firms i,

$$\frac{\partial x}{\partial e}+\frac{\partial x}{\partial \tau_m}\frac{d\tau_m}{de}+\frac{\partial x}{\partial P}\frac{dP}{de}+\frac{\partial x}{\partial z^*}\frac{dz^*}{de}=\frac{dz^*}{de}$$

$$\left(\mathbb{I}-\frac{\partial x}{\partial z^*}\right)\frac{dz^*}{de}=\frac{\partial x}{\partial e}+\frac{\partial x}{\partial \tau_m}\frac{d\tau_m}{de}+\frac{\partial x}{\partial P}\frac{dP}{de}$$

which yields our first equation,

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

where $\Psi^z=\left(\mathbb{I}-\frac{\partial x}{\partial z^*}\right)^{-1}$.

Next, we define the vector of excess demand ED as the stacked system of excess demand in goods and factor markets, where excess demand for good i is

$$ED_i=\sum_{n=1}^{N}C_{ni}+\sum_{j\in\mathcal{D}_i}x_{ji}-y_i,$$

and excess demand for factor f is

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

Market clearing requires excess demand to be zero, $ED=0$. Totally differentiating this system with regards to an exogenous variable e, we obtain

$$\frac{\partial ED}{\partial e}+\frac{\partial ED}{\partial z^*}\frac{dz^*}{de}+\frac{\partial ED}{\partial P}\frac{dP}{de}+\frac{\partial ED}{\partial \tau_m}\frac{d\tau_m}{de}=0.$$

Substituting in the equation for $\frac{dz^*}{de}$ and rearranging, we have

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

where $\Psi^P=-\left(\frac{\partial ED}{\partial P}+\frac{\partial ED}{\partial z^*}\Psi^z\frac{\partial x}{\partial P}\right)^{-1}$, concluding the proof.

A.2.5 Proof of Proposition 3

Country n solves

$$\max_{\tau_n}\mathcal{U}_n=W_{n_0}\left(p,\sum_{i\in\mathcal{I}_{n_0}\cap\mathcal{C}_m}V_i^o(\underline{\mathcal{J}}_i)+\sum_{i\in\mathcal{I}_{n_0}\backslash\mathcal{C}_m}V_i(\mathcal{J}_i)+\sum_{f\in\mathcal{F}_m}p_f^\ell\bar{\ell}_f\right)+u_{n_0}(z).$$

To reduce cumbersome notation, observe that without loss of generality we can define $V_i(\mathcal{J}_i)=V_i^o(\underline{\mathcal{J}}_i)$ for $i\in\mathcal{I}_n\backslash\mathcal{C}_m$, since in this case $\underline{\mathcal{J}}_i=\mathcal{J}_i$ and $x_{ij}^o=x_{ij}^*$. Therefore, we can rewrite the country n optimization problem as

$$\max_{\tau_{n_0}} \mathcal{U}_{n_0} = W_{n_0}\left(p, \sum_{i\in\mathcal{I}_{n_0}} V_i^o(\underline{\mathcal{J}}_i) + \sum_{f\in\mathcal{F}_m} p_f^\ell \bar{\ell}_f\right) + u_{n_0}(z).$$

First, we consider the effect on utility of a perturbation in ex post aggregates. Note that there is *no* direct impact of a perturbation in the hegemon's wedges, that is

$$\frac{\partial \mathcal{U}_n}{\partial \tau_m} = 0$$

which follows because $V_i^o(\underline{\mathcal{J}_i})$ is evaluated at the outside option. Next, for a perturbation to an aggregate z, by Envelope Theorem

$$\frac{\partial \mathcal{U}_{n_0}}{\partial z} = \frac{\partial W_{n_0}}{\partial w_{n_0}} \sum_{i\in\mathcal{I}_{n_0}} \left[\frac{\partial \Pi_i^o}{\partial z} + \tau_{n,i}\frac{\partial x_i^o}{\partial z} + \tau_{n,i}^\ell \frac{\partial \ell_i^o}{\partial z}\right] + \frac{\partial u_{n_0}}{\partial z}$$

Finally, for a price perturbation we have

$$\frac{\partial \mathcal{U}_{n_0}}{\partial P} = \frac{\partial W_{n_0}}{\partial P} + \frac{\partial W_{n_0}}{\partial w_{n_0}} \sum_{i\in\mathcal{I}_{n_0}} \left[\frac{\partial \Pi_i^o}{\partial P} + \frac{\partial x_i^o}{\partial P}\tau_{n,i} + \frac{\partial \ell_i^o}{\partial P}\tau_{n,i}^\ell\right] + \frac{\partial W_{n_0}}{\partial w_{n_0}} \sum_{f\in\mathcal{F}_m} \frac{\partial p_f^\ell}{\partial P}\bar{\ell}_f.$$

Finally, the direct impact of a tax perturbation in τ_n is, by Envelope Theorem,

$$\frac{\partial \mathcal{U}_{n_0}}{\partial \tau_n} = \frac{\partial W_{n_0}}{\partial w_{n_0}} \sum_{i\in\mathcal{I}_n} \left[\frac{\partial x_i^o}{\partial \tau_n}\tau_{n,i} + \frac{\partial \ell_i^o}{\partial \tau_n}\tau_{n,i}^\ell\right].$$

Re-stacking,

$$\tau_{n_0}\frac{\partial \mathbf{x}_i^o}{\partial \tau_{n_0}} = \sum_{i\in\mathcal{I}_{n_0}} \left[\frac{\partial x_i^o}{\partial \tau_{n_0}}\tau_{n_0,i} + \frac{\partial \ell_i^o}{\partial \tau_{n_0}}\tau_{n_0,i}^\ell\right]$$

Under this stacking convention, we can therefore write

$$\frac{\partial \mathcal{U}_{n_0}}{\partial z} = \frac{\partial W_{n_0}}{\partial w_{n_0}}\tau_{n_0}\frac{\partial \mathbf{x}_i^o}{\partial z} + \frac{\partial W_{n_0}}{\partial w_{n_0}} \sum_{i\in\mathcal{I}_{n_0}} \frac{\partial \Pi_i^o}{\partial z} + \frac{\partial u_{n_0}}{\partial z}$$

$$\frac{\partial \mathcal{U}_{n_0}}{\partial P} = \frac{\partial W_{n_0}}{\partial w_{n_0}}\tau_{n_0}\frac{\partial \mathbf{x}_i^o}{\partial P} + \frac{\partial W_{n_0}}{\partial P} + \frac{\partial W_{n_0}}{\partial w_{n_0}}\left[\sum_{i\in\mathcal{I}_{n_0}} \frac{\partial \Pi_i^o}{\partial P} + \sum_{f\in\mathcal{F}_m} \frac{\partial p_f^\ell}{\partial P}\bar{\ell}_f\right]$$

$$\frac{\partial \mathcal{U}_{n_0}}{\partial \tau_n} = \frac{\partial W_{n_0}}{\partial w_{n_0}}\tau_{n_0}\frac{\partial \mathbf{x}_i^o}{\partial \tau_{n_0}}$$

Now, we can put it all together. The first order conditions of country n are represented by the system

$$0 = \frac{\partial \mathcal{U}_{n_0}}{\partial \tau_{n_0}} + \frac{\partial \mathcal{U}_{n_0}}{\partial z}\frac{dz}{d\tau_{n_0}} + \frac{\partial \mathcal{U}_{n_0}}{\partial P}\frac{dP}{d\tau_{n_0}} + \frac{\partial \mathcal{U}_{n_0}}{\partial \tau_m}\frac{d\tau_m}{d\tau_n}.$$

Since the last term is equal to zero, substituting in we have

$$\begin{aligned}0 =&\frac{\partial W_{n_0}}{\partial w_{n_0}}\tau_{n_0}\frac{\partial \mathbf{x}_i^o}{\partial \tau_{n_0}}\\ &+\left[\frac{\partial W_{n_0}}{\partial w_{n_0}}\tau_{n_0}\frac{\partial \mathbf{x}_i^o}{\partial z}+\frac{\partial W_{n_0}}{\partial w_{n_0}}\sum_{i\in\mathcal{I}_{n_0}}\frac{\partial \Pi_i^o}{\partial z}+\frac{\partial u_{n_0}}{\partial z}\right]\frac{dz}{d\tau_{n_0}}\\ &+\left[\frac{\partial W_{n_0}}{\partial w_{n_0}}\tau_{n_0}\frac{\partial \mathbf{x}_i^o}{\partial P}+\frac{\partial W_{n_0}}{\partial P}+\frac{\partial W_{n_0}}{\partial w_{n_0}}\left[\sum_{i\in\mathcal{I}_{n_0}}\frac{\partial \Pi_i^o}{\partial P}+\sum_{f\in\mathcal{F}_m}\frac{\partial p_f^\ell}{\partial P}\bar{\ell}_f\right]\right]\frac{dP}{d\tau_{n_0}}.\end{aligned}$$

Rearranging, we obtain

$$\tau_{n_0}\frac{d\mathbf{x}_{n_0}^o}{d\tau_{n_0}}=-\left[\sum_{i\in\mathcal{I}_{n_0}}\frac{\partial \Pi_i^o}{\partial z}+\frac{1}{\frac{\partial W_{n_0}}{\partial w_{n_0}}}\frac{\partial u_{n_0}}{\partial z}\right]\frac{dz}{d\tau_{n_0}}-\left[\sum_{i\in\mathcal{I}_{n_0}}\frac{\partial \Pi_i^o}{\partial P}+\sum_{f\in\mathcal{F}_m}\frac{\partial p_f^\ell}{\partial P}\bar{\ell}_f+\frac{1}{\frac{\partial W_{n_0}}{\partial w_{n_0}}}\frac{\partial W_{n_0}}{\partial P}\right]\frac{dP}{d\tau_{n_0}}$$

where $\frac{d\mathbf{x}_{n_0}^o}{d\tau_{n_0}}=\frac{\partial \mathbf{x}_{n_0}^o}{\partial \tau_{n_0}}+\frac{\partial \mathbf{x}_{n_0}^o}{\partial z}\frac{dz}{d\tau_{n_0}}+\frac{\partial \mathbf{x}_{n_0}^o}{\partial P}\frac{dP}{d\tau_{n_0}}$.

Finally, it is helpful to rewrite the price effect. We have

$$\frac{\partial \Pi_i^o}{\partial P}=\frac{\partial p_i}{\partial P}y_i^o-\sum_{j\in\underline{\mathcal{J}}_i}\frac{\partial p_j}{\partial P}x_{ij}^o-\sum_{f\in\mathcal{F}_n}\frac{\partial p_j}{\partial P}x_{ij}^o$$

and similarly, we have

$$\frac{\partial W_n}{\partial P}=-\frac{\partial W_n}{\partial w_n}\sum_{i\in\mathcal{I}}\frac{\partial p_i}{\partial P}C_{ni}$$

Therefore, we can write

$$\sum_{i\in\mathcal{I}_{n_0}}\frac{\partial \Pi_i^o}{\partial P}+\sum_{f\in\mathcal{F}_m}\frac{\partial p_f^\ell}{\partial P}\bar{\ell}_f+\frac{1}{\frac{\partial W_{n_0}}{\partial w_{n_0}}}\frac{\partial W_{n_0}}{\partial P}=\sum_{i\in\mathcal{I}_{n_0}}\frac{\partial p_i}{\partial P}\left[y_i^o-\overline{x}_i^o-C_{ni}\right]-\sum_{i\in\mathcal{I}\setminus\mathcal{I}_{n_0}}\frac{\partial p_i}{\partial P}\left[C_{ni}+\overline{x}_i^o\right]+\sum_{f\in\mathcal{F}_m}\frac{\partial p_f^\ell}{\partial P}\left[\bar{\ell}_f-\ell_{ij}^o\right]$$

where we define $\overline{x}_i^o=\sum_{i\in\mathcal{I}_n}x_{ij}^o$. More generally, therefore, we can write

$$X_{n,i}^o=\mathbf{1}_{i\in\mathcal{I}_n}y_i^o-\sum_{i'\in\mathcal{I}_n}x_{i'i}^o-C_{ni}^o$$

$$X_{n,f}^o=\bar{\ell}_f-\sum_{i\in\mathcal{I}_n}x_{if}^o$$

and so write

$$\sum_{i\in\mathcal{I}_{n_0}}\frac{\partial \Pi_i^o}{\partial P}+\sum_{f\in\mathcal{F}_m}\frac{\partial p_f^\ell}{\partial P}\bar{\ell}_f+\frac{1}{\frac{\partial W_{n_0}}{\partial w_{n_0}}}\frac{\partial W_{n_0}}{\partial P}=X_n^o$$

Thus substituting into the tax formula,

$$\tau_{n_0}\frac{d\mathbf{x}_{n_0}^o}{d\tau_{n_0}}=-\left[\sum_{i\in\mathcal{I}_{n_0}}\frac{\partial \Pi_i^o}{\partial z}+\frac{1}{\frac{\partial W_{n_0}}{\partial w_{n_0}}}\frac{\partial u_{n_0}}{\partial z}\right]\frac{dz}{d\tau_{n_0}}-X_n^o\frac{dP}{d\tau_{n_0}}$$

A.2.6 Proof of Proposition 5

We first show that the global planner can, without loss, offer a trivial contract from the hegemon. Note that the first order conditions for firms are

$$\frac{\partial \Pi_i}{\partial x_{ij}} = \tau^x_{m,ij} + \tau^x_{n,ij}$$

$$\frac{\partial \Pi_i}{\partial \ell_{if}} = \tau^\ell_{m,if} + \tau^\ell_{n,if}$$

Therefore, if the allocation (x_i, ℓ_i) is implemented with wedges $(\tilde{\tau}_{m,i}, \tilde{\tau}_{n,i})$, it is also implemented with wedges $\tau_{m,i} = 0$ and $\tau_{n,i} = \tilde{\tau}_{m,i} + \tilde{\tau}_{n,i}$. Lastly side payments are ruled out since $\Omega_n \frac{\partial W_n}{\partial w_n} = 1$ by construction, and therefore the global planner can offer a trivial contract of the hegemon.

We can therefore instead characterize optimal wedges τ_n. Because the global planner has complete instruments on firms, we can adopt the primal approach. Noting that pecuniary externalities are zero (pure redistribution), then since the global planner's objective is

$$\mathcal{U}^G = \sum_{n=1}^N \Omega_n \Big[W_n(p, w_n) + u_n(z) \Big].$$

then the global planner's FOC for x_{ij} is

$$0 = \Omega_{n_0} \frac{\partial W_{n_0}}{\partial w_{n_0}} \frac{\partial \Pi_i}{\partial x_{ij}} + \sum_{n=1}^N \Omega_n \left[\frac{\partial W_n}{\partial w_n} \sum_{i \in \mathcal{I}_n} \frac{\partial \Pi_i}{\partial z_{ij}} + \frac{\partial u_n}{\partial z_{ij}} \right]$$

Using that $\Omega_n \frac{\partial W_n}{\partial w_n} = 1$, we have

$$\frac{\partial \Pi_i}{\partial x_{ij}} = - \sum_{i' \in \mathcal{I}} \frac{\partial \Pi_{i'}}{\partial z_{ij}} - \sum_n \frac{1}{\frac{\partial W_n}{\partial w_n}} \frac{\partial u_n}{\partial z_{ij}}$$

and therefore,

$$\tau^x_{n,ij} = - \sum_{i' \in \mathcal{I}} \frac{\partial \Pi_{i'}}{\partial z_{ij}} - \sum_n \frac{1}{\frac{\partial W_n}{\partial w_n}} \frac{\partial u_n}{\partial z_{ij}}.$$

Optimal wedges on factors are therefore zero since ℓ_{if} does not appear in the vector of aggregates.

A.2.7 Proof of Proposition 6

Absent a hegemon, the objective of country n is

$$\mathcal{U}_{n_0} = W_{n_0}\left(p, \sum_{i \in \mathcal{I}_{n_0}} V_i(\mathcal{J}_i) + \sum_{f \in \mathcal{F}_m} p^\ell_f \bar{\ell}_f \right) + u_{n_0}(z).$$

Since country n has complete controls over its domestic firms, we can employ the primal approach of directly selecting allocations of domestic firms. The optimality condition for x_{ij} is therefore

$$0 = \frac{\partial W_{n_0}}{\partial w_n} \frac{\partial \Pi_i}{\partial x_{ij}} + \left[\frac{\partial W_{n_0}}{\partial w_n} \sum_{i' \in \mathcal{I}_{n_0}} \frac{\partial \Pi_i}{\partial z} + \frac{\partial u_{n_0}}{\partial z} \right] \frac{dz}{dx_{ij}} + \frac{\partial W_{n_0}}{\partial P} \frac{dP}{dx_{ij}}.$$

From the first order condition of firm i, we have $\tau^x_{n,ij} = \frac{\partial \Pi_i}{\partial x_{ij}}$, and therefore

$$\tau^x_{n,ij} = -\left[\sum_{i' \in \mathcal{I}_{n_0}} \frac{\partial \Pi_i}{\partial z} + \frac{1}{\frac{\partial W_{n_0}}{\partial w_n}} \frac{\partial u_{n_0}}{\partial z}\right] \frac{dz}{dx_{ij}} - \frac{1}{\frac{\partial W_{n_0}}{\partial w_n}} \frac{\partial W_{n_0}}{\partial P} \frac{dP}{dx_{ij}}.$$

Lastly, we need to decompose out the term $\frac{\partial W_n}{\partial P}$. We have

$$\frac{\partial W_n}{\partial P} = \frac{\partial W_n}{\partial p} + \frac{\partial W_n}{\partial w_n} \frac{\partial w_n}{\partial P}$$

Following the proofs of Propositions 1 and 3, we have

$$\frac{\partial W_n}{\partial p} = -\frac{\partial W_n}{\partial w_n} \sum_{i \in \mathcal{I}} \frac{\partial p_i}{\partial P} C_{ni}$$

and

$$\frac{\partial w_n}{\partial P} = \sum_{i \in \mathcal{I}_n} \frac{\partial \Pi_i}{\partial P} + \sum_{f \in \mathcal{F}_n} p^\ell_f \bar{\ell}_f = \frac{\partial p_i}{\partial P} y_i - \sum_{i \in \mathcal{I}_n} \sum_{j \in \mathcal{J}_i} \frac{\partial p_j}{\partial P} x_{ij}$$

where factor payments drop out by market clearing. Therefore, we have

$$\frac{\partial W_{n_0}}{\partial P} = \frac{\partial W_{n_0}}{\partial w_{n_0}} \sum_{i' \in \mathcal{I}} X_{n,i} \frac{\partial p_i}{\partial P}$$

where $X_{n,i} = \mathbf{1}_{i \in \mathcal{I}_n} y_i - \sum_{i \in \mathcal{I}_{n_0}} x_{ij} - C_{n_0 i}$. Thus substituting back into the optimal tax formula, we have

$$\tau^x_{n,ij} = -\left[\sum_{i' \in \mathcal{I}_{n_0}} \frac{\partial \Pi_{i'}}{\partial z} + \frac{1}{\frac{\partial W_{n_0}}{\partial w_n}} \frac{\partial u_n}{\partial z}\right] \frac{dz}{dx_{ij}} - \sum_{i' \in \mathcal{I}} X_{n,i'} \frac{\partial p_{i'}}{\partial P} \frac{dP}{dx_{ij}}.$$

Factor wedges are derived analogously,

$$\tau^\ell_{n,if} = -\left[\sum_{i' \in \mathcal{I}_n} \frac{\partial \Pi_{i'}}{\partial z} + \frac{1}{\frac{\partial W_n}{\partial w_n}} \frac{\partial u_n}{\partial z}\right] \frac{dz}{d\ell_{if}} - \sum_{i' \in \mathcal{I}} X_{n,i'} \frac{\partial p_{i'}}{\partial P} \frac{dP}{d\ell_{if}}$$

A.2.8 Proof of Proposition 4

The hegemon's ex ante policy is to maximize the ex post utility, that is the ex post Lagrangian, $\max_{\{\tau_{m,i}\}_{i \in \mathcal{I}_m}} \mathcal{L}_m$. Note that the nested optimization problem $\max_{\{\tau_{m,i}\}_{i \in \mathcal{I}_m}} \max_{\{\Gamma_i\}_{i \in D_m}} W_m$ can equivalently be represented as a single decision problem of choosing domestic policies and the contract. Moreover, given complete wedges, this problem can be represented under the primal approach of choosing allocations $\{x_i, \ell_i\}_{i \in \mathcal{I}_m \cup \mathcal{C}_m}$ subject to participation constraints. Under this primal representation, the hegemon's Lagrangian is

$$\begin{aligned}\mathcal{L}_m =& W_m\left(p, \sum_{i \in \mathcal{I}_m} \Pi_i(x_i, \ell_i, \mathcal{J}_i) + \sum_{f \in \mathcal{F}_m} p^\ell_f \bar{\ell}_f + \sum_{i \in C_m} \left(\Pi_i(x_i, \ell_i, \mathcal{J}_i) - \tau^x_{n,i} x_i - \tau^\ell_{n,i} \ell_i + r^*_{n,i} - V^o_i(\underline{\mathcal{J}}_i)\right)\right) + u_m(z) \\ &+ \sum_{i \in \mathcal{C}_m} \eta_i \left[\Pi_i(x_i, \ell_i, \mathcal{J}_i) - \tau^x_{n,i} x_i - \tau^\ell_{n,i} \ell_i + r^*_{n,i} - V^o_i(\underline{\mathcal{J}}_i)\right]\end{aligned}$$

The corresponding FOC for x_{ij} is

$$0 = \frac{\partial \mathcal{L}_m}{\partial x_{ij}} + \frac{\partial \mathcal{L}_m}{\partial z}\frac{dz}{dx_{ij}} + \frac{\partial \mathcal{L}_m}{\partial P}\frac{dP}{dx_{ij}}$$

The direct effect for $i \in \mathcal{I}_m$ is

$$\frac{\partial \mathcal{L}_m}{\partial x_{ij}} = \frac{\partial W_m}{\partial w_m}\frac{\partial \Pi_i}{\partial x_{ij}} = \frac{\partial W_m}{\partial w_m}\tau^x_{m,ij}$$

Finally, indirect effects are analogous to those of the hegemon's ex post problem, except for the removal of reoptimization of $\{x_i, \ell_i\}_{i\in\mathcal{I}_m}$ (owing to the primal representation). Therefore following the proof of Proposition 1, we have

$$\begin{aligned}\tau^x_{m,ij} = &-\Bigg[\sum_{i\in\mathcal{I}_m}\frac{\partial \Pi_i}{\partial z} + \frac{1}{\frac{\partial W_m}{\partial w_m}}\frac{\partial u_m}{\partial z}\Bigg]\frac{dz}{dx_{ij}} - \sum_{i\in\mathcal{I}} X_{m,i}\frac{\partial p_i}{\partial P}\frac{dP}{dx_{ij}} \\ &- \sum_{i\in\mathcal{C}_m}\left(1 + \frac{1}{\frac{\partial W_m}{\partial w_m}}\eta_i\right)\Bigg[\left(\frac{\partial \Pi_i}{\partial z} - \frac{\partial \Pi^o_i}{\partial z}\right)\frac{dz}{dx_{ij}} + \left(\frac{\partial \Pi_i}{\partial P} - \frac{\partial \Pi^o_i}{\partial P}\right)\frac{dP}{dx_{ij}}\Bigg]\end{aligned}$$

Factor wedges are derived analogously,

$$\tau^\ell_{m,if} = -\Bigg[\sum_{k\in\mathcal{I}_m}\frac{\partial \Pi_k}{\partial z} + \frac{1}{\frac{\partial W_m}{\partial w_m}}\frac{\partial u_m}{\partial z}\Bigg]\frac{dz}{d\ell_{if}} - \sum_{k\in\mathcal{I}} X_{m,k}\frac{\partial p_k}{\partial P}\frac{dP}{d\ell_{if}} \tag{A.1}$$

$$- \sum_{k\in\mathcal{C}_m}\left(1 + \frac{1}{\frac{\partial W_m}{\partial w_m}}\eta_k\right)\Bigg[\left(\frac{\partial \Pi_k}{\partial z} - \frac{\partial \Pi^o_k}{\partial z}\right)\frac{dz}{d\ell_{if}} + \left(\frac{\partial \Pi_k}{\partial P} - \frac{\partial \Pi^o_k}{\partial P}\right)\frac{dP}{d\ell_{if}}\Bigg] \tag{A.2}$$

A.2.9 Proof of Corollary 1

Specializing Proposition 5 to the application, we have

$$\tau^x_{n,ij} = -\sum_{n=1}^{N}\frac{\partial \Pi_i}{\partial z_{ij}} = -\sum_{n=1}^{N} p_i \frac{\partial f_i}{\partial [A_j x^\sigma_{inj}]}\frac{\partial A_j}{\partial z_{ij}} x^\sigma_{inj} = -\xi_j \frac{1}{N}\sum_{n=1}^{N} p_i \frac{\partial f_i}{\partial [A_j x^\sigma_{inj}]}\sigma \overline{A}_j z_{ij}^{\xi_j\sigma - 1} x^\sigma_{inj}$$

From the firm's first order condition, we also have

$$p_j + \tau^x_{n,inj} = p_i \frac{\partial f_i}{\partial [A_j x^\sigma_{inj}]} A_j x^{\sigma-1}_{inj}\sigma$$

So that substituting in,

$$\tau^x_{n,ij} = -\xi_j \frac{1}{N}\sum_{n=1}^{N}(p_j + \tau^x_{n,inj})\frac{x_{inj}}{z_{ij}}.$$

Finally, using that the global planner's problem is symmetric across countries n, we have $\tau^x_{n,ij} = -\xi_j(p_j + \tau^x_{n,ij})$, which reduces to

$$\tau^x_{n,ij} = -\frac{\xi_j}{1+\xi_j}p_j$$

The derivation of $\tau^x_{n,ih}$ proceeds in the same manner except the spillover is only domestic.

A.2.10 Proof of Corollary 2

Taking $N \to \infty$, each country takes A_j as given and so sets $\tau_{n,i_nj} = 0$. That $\tau_{n,i_nh} = -\frac{\xi_h}{1+\xi_h} p_h$ follows the same proof as for the global planner.

A.2.11 Proof of Corollary 3

First consider the tax on j. As presented in text,

$$\tau^x_{m,ij} = -\sum_{n=1}^{N} \frac{\partial \Pi_{i_n}}{\partial z_{ij}} = -\xi_j \frac{1}{N} \sum_{n=1}^{N} p_i \frac{\partial f_i}{\partial [A_j(z) x^\sigma_{i_nj}]} \sigma \overline{A}_j z_{ij}^{\xi_j \sigma - 1} x^\sigma_{i_nj}$$

The firm's FOC is for j is

$$p_i \frac{\partial f_i}{\partial [A_j x^\sigma_{i_nj}]} \sigma A_j x^{\sigma-1}_{i_nj} = p_j + \tau^x_{m,i_nj} + \tau^x_{n,ij}$$

where we have used symmetry, $\tau_{n,i_nj} = \tau^x_{n,ij}$. Substituting the firm's FOC into the tax formula and exploiting symmetry,

$$\tau^x_{m,ij} = -\xi_j (p_j + \tau^x_{m,ij} + \tau^x_{n,ij}),$$

which yields the result,

$$\tau^x_{m,ij} = -\frac{\xi_j}{1+\xi_j}(p_j + \tau^x_{n,ij}).$$

Next, consider the hegemon's tax on h, which as in text is

$$\tau^x_{m,ih} = -\left(\frac{\partial \Pi_i}{\partial z_{ih}} - \frac{\partial \Pi^o_i}{\partial z_{ih}} \right).$$

By Envelope Theorem,

$$\frac{\partial \Pi^o_i}{\partial z_{ih}} = p_i \frac{\partial f^o_i}{\partial [A_{i_nh} x^{o\sigma}_{i_nh}]} \overline{A}_j \xi \sigma z^{\xi\sigma-1}_{i_nh} x^{o\sigma}_{i_nh},$$

so that using the firm's first order condition at the outside option,

$$p_i \frac{\partial f^o_i}{\partial [A_{i_nh} x^{o\sigma}_{i_nh}]} A_j x^{o\sigma-1}_{i_nh} \sigma = p_j + \tau^x_{n,i_nh}$$

we therefore have

$$\frac{\partial \Pi^o_{i_n}}{\partial z_{i_nh}} = \xi_h (p_j + \tau^x_{n,i_nh}) \frac{x^o_{i_nh}}{z_{i_nh}}$$

Thus substituting in,

$$\tau^x_{m,ih} = -\xi_h \left(\left(p_j + \tau_{m,ih} + \tau_{n,ih} \right) - \left(p_j + \tau_{n,ih} \right) \frac{x^o_{ih}}{z_{ih}} \right)$$

Finally, rearranging gives

$$\tau^x_{m,ih} = \frac{\xi_h}{1+\xi_h} \left(\frac{x^o_{ih}}{x^*_{ih}} - 1 \right) \left(p_j + \tau^x_{n,ih} \right)$$

which completes the proof.

A.2.12 Proof of Proposition 7

In absence of anticoercion policies, the hegemon's optimization problem can be given by the primal approach as

$$\max \sum_{n=1}^{N} [\Pi_{i_n} - \Pi^o_{i_n}]$$

Given symmetry, the hegemon optimally selects the same allocations $(x_{i_n j}, x_{i_n h}) = (x_{ij}, x_{ih})$ for every country. Thus we can equivalently represent the problem,

$$\max \Pi_i(x_{ij}, x_{ih}, z) - \Pi^o_i(z_{ih})$$

where $A_j = \overline{A}_j x_{ij}^{\xi_j \sigma}$. As compared to the global planner's problem, the only difference is the hegemon subtracts off the term $\Pi^o_i(z_{ih})$ in the objective. We thus proceed by writing the objective

$$\max \Pi_i(x_{ij}, x_{ih}, x) - \theta \Pi^o_i(z_{ih})$$

for $\theta \geq 0$ and apply monotone comparative statics regarding θ. First, since $\sigma > 0$ and $\beta < \sigma$, then $\frac{\partial^2 f_i}{\partial x_{ij} \partial x_{ih}} < 0$ and so the objective is supermodular in $(x_{ij}, -x_{ih})$. Second, since $\frac{\Pi^o_i}{\partial z_{ih}} > 0$ and $\frac{\partial \Pi^o_i}{\partial z_{ij}} = 0$, then the objective has increasing differences in $((x_{ij}, -x_{ih}), \theta)$. Therefore, $(x^*_{ij}, -x^*_{ih})$ is increasing in θ. Hence, the hegemon's solution features higher x^*_{ij} and lower x^*_{ih} than the global planner's solution.

A.2.13 Proof of Proposition 8

Suppose that all countries $-n$ adopt symmetric policies, so that the hegemon adopts symmetric allocations for all countries $-n$. We can therefore write the hegemon's objective as

$$\mathcal{U}_m = \Pi_{i_n} - \Pi^o_{i_n} + (N-1)(\Pi_{i_{-n}} - \Pi_{i_{-n}})$$

with choice variables $(x_{i_n j}, x_{i_n h}, x_{i_{-n} j}, x_{i_{-n} h})$. To simplify notation for the proof, we will note these by $(x_{ij}, x_{ih}, X_{ij}, X_{ih})$.

The proof proceeds in two steps. First, we show that the hegemon's objective is supermodular in $(x_{ij}, -x_{ih}, X_{ij}, -X_{ih})$. Then, we show increasing differences in the relevant comparative statics.

Supermodularity. We first show that the objective is supermodular in $(x_{ij}, -x_{ih}, X_{ij}, -X_{ih})$. We do so by separately showing that both components of the objective are supermodular. Note that cross partials in Π^o_i are all zero, so it suffices to show that Π_i is supermodular, which entails only showing the production function itself is supermodular. The production function has the generic form

$$f = \left((a x_{ij}^{\xi_j \sigma} + b X_{ij}^{\xi_j \sigma}) x_{ij}^{\sigma} + c(-x_{ih})^{(\xi_h + 1)\sigma} \right)^{\beta/\sigma}$$

where we note that given this generic form, it is arbitrary whether this is the production function of n or of $-n$, thus showing supermodularity of this function suffices. First, all cross partials in X_{ih} are zero.

Next, we have

$$\frac{\partial f}{\partial x_{ih}} = -\beta\left((ax_{ij}^{\xi_j\sigma} + bX_{ij}^{\xi_j\sigma})x_{ij}^{\sigma} + c(-x_{ih})^{(\xi_h+1)\sigma}\right)^{\frac{\beta}{\sigma}-1} c(\xi_h+1)(-x_{ih})^{(\xi_h+1)\sigma-1}$$

so that since $\beta \leq \sigma$ we have

$$\frac{\partial^2 f}{\partial x_{ih}\partial x_{ij}} = \left(1-\frac{\beta}{\sigma}\right)\beta\left((ax_{ij}^{\xi_j\sigma}+bX_{ij}^{\xi_j\sigma})x_{ij}^{\sigma}+c(-x_{ih})^{(\xi_h+1)\sigma}\right)^{\frac{\beta}{\sigma}-1} c(\xi_h+1)(-x_{ih})^{(\xi_h+1)\sigma-2}\frac{\partial\left[(ax_{ij}^{\xi_j\sigma}+bX_{ij}^{\xi_j\sigma})x_{ij}^{\sigma}\right]}{\partial x_{ij}} \geq 0$$

$$\frac{\partial^2 f}{\partial x_{ih}\partial X_{ij}} = \left(1-\frac{\beta}{\sigma}\right)\beta\left((ax_{ij}^{\xi_j\sigma}+bX_{ij}^{\xi_j\sigma})x_{ij}^{\sigma}+c(-x_{ih})^{(\xi_h+1)\sigma}\right)^{\frac{\beta}{\sigma}-2} c(\xi_h+1)(-x_{ih})^{(\xi_h+1)\sigma-1}\frac{\partial\left[(ax_{ij}^{\xi_j\sigma}+bX_{ij}^{\xi_j\sigma})x_{ij}^{\sigma}\right]}{\partial X_{ij}} \geq 0$$

Finally, we have

$$\frac{\partial f}{\partial X_{ij}} = \beta\left((ax_{ij}^{\xi_j\sigma} + bX_{ij}^{\xi_j\sigma})x_{ij}^{\sigma} + c(-x_{ih})^{(\xi_h+1)\sigma}\right)^{\frac{\beta}{\sigma}-1} \xi_j b X_{ij}^{\xi_j\sigma-1}x_{ij}^{\sigma}$$

so that

$$\begin{aligned}\frac{\partial^2 f}{\partial X_{ij}\partial x_{ij}} = & \left(\frac{\beta}{\sigma}-1\right)\beta\left((ax_{ij}^{\xi_j\sigma} + bX_{ij}^{\xi_j\sigma})x_{ij}^{\sigma} + c(-x_{ih})^{(\xi_h+1)\sigma}\right)^{\frac{\beta}{\sigma}-2} \xi_j b X_{ij}^{\xi_j\sigma-1}x_{ij}^{\sigma}\frac{\partial\left[(ax_{ij}^{\xi_j\sigma}+bX_{ij}^{\xi_j\sigma})x_{ij}^{\sigma}\right]}{\partial x_{ij}} \\ & +\beta\left((ax_{ij}^{\xi_j\sigma} + bX_{ij}^{\xi_j\sigma})x_{ij}^{\sigma} + c(-x_{ih})^{(\xi_h+1)\sigma}\right)^{\frac{\beta}{\sigma}-1} \xi_j b X_{ij}^{\xi_j\sigma-1}x_{ij}^{\sigma-1}\sigma\end{aligned}$$

This is positive if

$$\left((ax_{ij}^{\xi_j\sigma} + bX_{ij}^{\xi_j\sigma})x_{ij}^{\sigma} + c(-x_{ih})^{(\xi_h+1)\sigma}\right)\sigma \geq \left(1-\frac{\beta}{\sigma}\right)x_{ij}\frac{\partial\left[(ax_{ij}^{\xi_j\sigma}+bX_{ij}^{\xi_j\sigma})x_{ij}^{\sigma}\right]}{\partial x_{ij}}$$

which simplifies to

$$1 \geq \left(1-\frac{\beta}{\sigma}\right)\left[\frac{(1+\xi_j)ax_{ij}^{(1+\xi_j)\sigma} + bX_{ij}^{\xi_j\sigma}x_{ij}^{\sigma}}{ax_{ij}^{(1+\xi_j)\sigma} + bX_{ij}^{\xi_j\sigma}x_{ij}^{\sigma} + c(-x_{ih})^{(\xi_h+1)\sigma}}\right]$$

Finally, we can bound

$$\frac{(1+\xi_j)ax_{ij}^{(1+\xi_j)\sigma} + bX_{ij}^{\xi_j\sigma}x_{ij}^{\sigma}}{ax_{ij}^{(1+\xi_j)\sigma} + bX_{ij}^{\xi_j\sigma}x_{ij}^{\sigma} + c(-x_{ih})^{(\xi_h+1)\sigma}} \leq (1+\xi_j)\frac{ax_{ij}^{(1+\xi_j)\sigma} + bX_{ij}^{\xi_j\sigma}x_{ij}^{\sigma}}{ax_{ij}^{(1+\xi_j)\sigma} + bX_{ij}^{\xi_j\sigma}x_{ij}^{\sigma}} = (1+\xi_j)$$

so that the sufficient condition is

$$\left(1-\frac{\beta}{\sigma}\right)(1+\xi_j) \leq 1,$$

which was assumed. Therefore, the hegemon's objective is supermodular.

Monotone Comparative Statics. Given supermodularity, we next invoke monotone comparative statics. First we take τ^x_{n,i_nj}. Since the outside option does not depend on τ^x_{n,i_nj} and since countries $-n$ objectives do not depend on τ^x_{n,i_nj}, we have (ignoring the optimization-irrelevant constant for the hegemon of the domestic remitted revenues)

$$\frac{\partial \mathcal{U}_m}{\partial \tau^x_{n,i_nj}} = -x_{i_nj}$$

Therefore, $\mathcal{U}_m$ has increasing differences in $((x_{ij}, X_{ij}, -x_{ih}, -X_{ih}), -\tau^x_{n,i_nj})$. Therefore, (x_{ij}, X_{ij}) decrease in τ^x_{n,i_nj} while $(-x_{ih}, -X_{ih})$ increase in τ^x_{n,i_nj}, yielding the first result.

Next, we take τ^x_{n,i_nh}. By Envelope Theorem, we have

$$\frac{\partial \mathcal{U}_m}{\partial \tau^x_{n,i_nj}} = -x_{i_nh} + x^o_{i_nh}$$

All cross partials apart from x_{i_nh} are thus zero. On the other hand for x_{i_nh}, we have

$$\frac{\partial^2 \mathcal{U}_m}{\partial \tau^x_{n,i_nj} \partial(-x_{i_nh})} = 1 - \frac{\partial x^o_{i_nh}}{\partial x_{i_nh}}$$

Recall that demand $x^o_{i_nh}$ is given by

$$x^o_{i_nh} = \left[\frac{p_i \beta}{p_j + \tau_{n,i_nh}} \left(\overline{A}_h^{1/\sigma} \right)^\beta \right]^{\frac{1}{1-\beta}} x_{i_nh}^{\frac{\xi_h \beta}{1-\beta}}$$

so that we have

$$\frac{\partial x^o_{i_nh}}{\partial x_{i_nh}} = \left[\frac{p_i \beta}{p_j + \tau_{n,i_nh}} \left(\overline{A}_h^{1/\sigma} \right)^\beta \right]^{\frac{1}{1-\beta}} x_{i_nh}^{\frac{\xi_h \beta}{1-\beta} - 1} \frac{\xi_h \beta}{1-\beta}.$$

Given a lower bound $x_{i_nh} \geq \underline{x}$, then we can bound

$$\frac{\partial x^o_{i_nh}}{\partial x_{i_nh}} \leq c \xi_h$$

where $c = \left[\frac{p_i \beta}{p_j + \tau_{n,i_nh}} \left(\overline{A}_h^{1/\sigma} \right)^\beta \right]^{\frac{1}{1-\beta}} \underline{x}^{-1} \frac{\beta}{1-\beta} > 0$. Thus for any $\xi_h < \frac{1}{c}$, we have

$$\frac{\partial^2 \mathcal{U}_m}{\partial \tau^x_{n,i_nj} \partial(-x_{i_nh})} > 1 - c\frac{1}{c} = 0$$

and so we have increasing differences in $((x_{ij}, X_{ij}, -x_{ih}, -X_{ih}), \tau^x_{n,i_nh})$. Therefore, (x_{ij}, X_{ij}) increases in τ^x_{n,i_nh} while $(-x_{ih}, -X_{ih})$ decreases in τ^x_{n,i_nh}, yielding the second result. This completes the proof.

A.2.14 Proof of Proposition 9

Consider the objective of the country n government, which solves

$$\max_{\tau_n} \Pi^o_i$$

where we have

$$\Pi_i^o = \max_{x_{i_nh}^o} p_i \overline{A}_h^{\beta/\sigma} z_{i_nh}^{\xi_h\beta} x_{i_nh}^{o\beta} - p_h x_{i_nh}^o - \tau_{i_nh}(x_{i_nh}^o - x_{i_nh}^{o*}),$$

where the optimal policy is

$$x_{i_nh}^{o*} = \left[\frac{p_i\beta}{p_j + \tau_{n,i_nh}}\left(\overline{A}_h^{1/\sigma}\right)^\beta\right]^{\frac{1}{1-\beta}} z_{i_nh}^{\frac{\xi_h\beta}{1-\beta}}.$$

Substituting in the optimal policy, we have

$$\Pi_i^o = \left[p_i\overline{A}_h^{\beta/\sigma}\left[\frac{p_i\beta}{p_h + \tau_{n,i_nh}}\left(\overline{A}_h^{1/\sigma}\right)^\beta\right]^{\frac{\beta}{1-\beta}} - p_h\left[\frac{p_i\beta}{p_h + \tau_{n,i_nh}}\left(\overline{A}_h^{1/\sigma}\right)^\beta\right]^{\frac{1}{1-\beta}}\right] z_{i_nh}^{\frac{\xi_h\beta}{1-\beta}}.$$

Therefore, we have

$$\frac{\partial\Pi_i^o}{\partial z_{i_nh}} > 0$$

$$\frac{\partial\Pi_i^o}{\partial z_{i_nj}} = 0$$

$$\frac{\partial\Pi_i^o}{\partial z_{i_rj}}, \frac{\partial\Pi_i^o}{\partial z_{i_rh}} = 0 \quad \forall r \neq n$$

that is, the welfare of country n is increasing in home use z_{i_nh} and constant in all other other elements of z. From Proposition 8, we therefore have

$$\frac{\partial\Pi_i^o}{\partial \tau_{n,i_nj}} = \frac{\partial\Pi_i^o}{\partial z_{i_nh}}\frac{\partial z_{i_nh}}{\partial \tau_{n,i_nj}^x} \geq 0$$

and therefore, welfare is maximized by $\tau_{n,i_nj}^x \to \infty$.

Given $\tau_{n,i_nj} \to \infty$ (i.e., a ban on j), the hegemon optimally sets $x_{ij} = 0$. Setting $\tau_{n,i_nh} \neq 0$ would then require setting $T_{i_n} < 0$, which is not optimal, hence $\tau_{n,i_nh} = T_{i_n} = 0$. As a result, policies applied to the firm at the inside and outside option are identical, and therefore $z_{i_nh} = x_{i_nh}^o$. Thus, the problem of country n reduces to a primal optimization problem of

$$\max_{z_{i_nh}} p_i\overline{A}_h^{\beta/\sigma} z_{i_nh}^{\xi_h\beta} z_{i_nh}^\beta - p_h z_{i_nh},$$

whose solution is implemented by $\tau_{n,i_nh} = -\frac{\xi_h}{1+\xi_h}p_h$. This concludes the proof.

A.2.15 Proof of Proposition 10

The first result follows since in the fragmentation equilibrium (as compared to the cooperative equilibrium),

$$\Pi_i^o = \max_{z_{i_nh}} p_i\overline{A}_j^{\beta/\sigma} z_{i_nh}^{\xi_h\beta} z_{i_nh}^\beta - p_h z_{i_nh} < \max_{x_{i_nj}, x_{i_nh}} p_i\left(A_j x_{i_nj}^\sigma + \overline{A}_h x_{i_nh}^{\xi_h\sigma} x_{i_nh}^\sigma\right)^{\beta/\sigma} - p_j x_{ij} - p_h x_{ih}$$

which follows from the Inada condition. The second result follows since in the hegemon's equilibrium with $\xi_h = 0$,

$$\Pi_i^o = \max_{x_{inh}^o} p_i \overline{A}_h^{\beta/\sigma} x_{inh}^{o\beta} - p_h x_{inh}^o < \max_{x_{inj}, x_{inh}} p_i \left(A_j x_{inj}^\sigma + \overline{A}_h x_{inh}^\sigma \right)^{\beta/\sigma} - p_j x_{ij} - p_h x_{ih}$$

which again follows from the Inada condition.

A.2.16 Proof of Proposition 11

Firm i has a nested optimization problem. We begin with the expenditure minimization problem for the industry J good,

$$\min \sum_n p_{iJn} x_{iJn} \quad s.t. \quad \left(\sum_n \alpha_{iJn} x_{iJn}^{\frac{\sigma_j - 1}{\sigma_J}} \right)^{\frac{\sigma_J}{\sigma_J - 1}} \geq X_{iJ}$$

where $p_{iJn} = p_{Jn}(1 + \bar{t}_{iJn})$. Derivations are standard but enumerated for completeness. We have from the first order conditions

$$x_{iJn} = \left(\frac{\alpha_{iJn}}{p_{iJn}} \right)^{\sigma_J} \left(\frac{\alpha_{iJl}}{p_{iJl}} \right)^{-\sigma_J} x_{iJl}.$$

Substituting into the constraint,

$$x_{iJn} = \frac{1}{\left(\sum_l \alpha_{iJl}^{\sigma_J} p_{iJl}^{1-\sigma_J} \right)^{\frac{\sigma_J}{\sigma_J - 1}}} \left(\frac{\alpha_{iJn}}{p_{iJn}} \right)^{\sigma_J} X_{iJ}.$$

Thus substituting back into expenditures, we have

$$\sum_n p_{iJn} x_{iJn} = \sum_{iJn} \frac{\alpha_{iJn}^{\sigma_J} p_{iJn}^{1-\sigma_J} X_{iJ}}{\left(\sum_l \alpha_{iJl}^{\sigma_J} p_{iJl}^{1-\sigma_J} \right)^{\frac{\sigma_J}{\sigma_J - 1}}} = \sum_{iJn} \left(\alpha_{iJn}^{\sigma_J} p_{iJn}^{1-\sigma_J} \right)^{-\frac{1}{\sigma_J - 1}} X_{iJ}$$

and so we can denote the price of intermediate J for firm i as

$$P_{iJ} = \sum_{iJn} \left(\alpha_{iJn}^{\sigma_J} p_{iJn}^{1-\sigma_J} \right)^{-\frac{1}{\sigma_J - 1}} \tag{A.3}$$

The outer problem is thus given by

$$\max_{X_{iJ}} f_i(\{X_{iJ}\}) - \sum_{J \in \mathcal{J}} P_{iJ} X_{iJ}$$

so that X_{iJ}^* depends on (α_{iJn}, p_{iJn}) only through the price indices. This then allows us to write demand as

$$x_{iJn} = \left(\frac{\alpha_{iJn}}{p_{iJn} P_{iJ}} \right)^{\sigma_J} X_{iJ}. \tag{A.4}$$

Taking logs, we have

$$\log x_{iJn} = \log X_{iJ} - \sigma_J \log P_{iJ} + \sigma_J \log \alpha_{iJn} - \sigma_J \log p_{iJn}$$

Substituting $p_{iJn} = p_{Jn}(1 + \bar{t}_{iJn})$ yields

$$\log x_{iJn} = \log X_{iJ} - \sigma_J \log P_{iJ} - \sigma_J \log p_{Jn} + \sigma_J \log \alpha_{iJn} - \sigma_J \log(1 + \bar{t}_{iJn}).$$

Finally, we define $\gamma_{iJ} = \log X_{iJ} - \sigma_J \log P_{iJ}$ and define $\gamma_{Jn} = -\sigma_J \log p_{Jn}$ to obtain

$$\log x_{iJn} = \gamma_{iJ} + \gamma_{Jn} + \sigma_J \log \alpha_{iJn} - \sigma_J \log(1 + \bar{t}_{iJn})$$

which gives the result.

A.3 Extensions

A.3.1 Coercing Governments

We extend our framework to allow the hegemon to coerce both firms (as in the baseline model) and also governments. We assume that in the Middle, each government n can choose a diplomatic action $a_n \in \mathbb{R}$.[4] Examples of diplomatic actions include votes at the UN, diplomatic recognition of another country, positions on international issues such as human rights, and conflict. The representative consumer of country n receives separable utility $\psi_n(a)$ from the vector of diplomatic actions chosen by all countries, meaning that country n's utility potentially depends on the diplomatic actions of other countries. The total utility of the country n representative consumer is $W(p, w_n) + u_n(z) + \psi_n(a)$.

The hegemon can attempt to influence the diplomatic action undertaken by foreign governments. In particular, simultaneously with offering contracts to foreign firms, the hegemon also offers a contract to each foreign government n. The contract the hegemon offers specifies: (i) a diplomatic action a_n^* that country n will undertake; (ii) a punishment $\mathcal{P}_n^g$ for rejecting the contract, which is a restriction that firms $i \in \mathcal{I}_n$ can only use a subset of inputs $\mathcal{J}_i^g$. We use the notation $\mathcal{J}_i^g$ to differentiate punishments from the government rejecting the contract, to punishments from an individual firm rejecting the contract. Punishments must be feasible as before.[5] Each firm and government simultaneously chooses whether to accept or reject the contract, taking as given the acceptance decisions of other entities. If firm $i \in \mathcal{I}_n$ accepts the contract but government n rejects the contract, the firm i avoids punishment $\mathcal{P}_i$ but incurs punishment $\mathcal{P}_{ni}^g$ associated with the government's contract rejection.

Government Participation Constraint. Each government voluntarily chooses to accept or reject the hegemon's contract. If government n accepts the hegemon's contract, it receives utility $\mathcal{U}_n^* + \psi_n(a^*)$. It is important to note that the government's inside option $\mathcal{U}_n^*$ involves all of its firms accepting the hegemon's contract and, hence, being held to their outside options. If instead it rejects the contract, it instead receives utility

$$\mathcal{U}_n^o(\mathcal{P}_n^g) + \sup_{a_n} \psi_n(a_n, a_{-n}^*)$$

[4] It is immediate to extend results to $a_n \in \mathcal{A}_n \subset \mathbb{R}^M$ for $M \geq 1$

[5] We could extend analysis to also allow the hegemon to cut off sales to the country n consumer, which increases the potential scope for punishments.

where $\mathcal{U}_n^o$ is the consumption and z-externality utility of its representative consumer in the equilibrium in which it incurs punishment $\mathcal{P}_n^g$. This gives rise to the government's participation constraint

$$\mathcal{U}_n^* + \psi_n(a^*) \geq \mathcal{U}_n^o(\mathcal{P}_n^g) + \sup_{a_n} \psi_n(a_n, a_{-n}^*). \tag{A.5}$$

The participation constraint compares the benefit of its firms retaining access to the hegemon's goods against the cost of having to comply with the hegemon's preferred diplomatic action. As with individual firms, the hegemon's power over government n limits the extent to which it can distort the government's diplomatic action away from that country's preferred level.

Hegemon's Optimal Wedges and Actions. Lemma 1, which proves the optimality of maximal punishments for firms that reject the hegemon's contract, follows by the same argument as before. Unlike with firms, however, the optimality of maximal punishments is not immediate for governments, since the equilibrium changes off-path in response to a punishment of a government. Instead, the optimal punishment of government n is the one that minimizes its outside option, that is

$$\mathcal{P}_n^{g*} = \arg\inf_{P_n^g} \mathcal{U}_n^o(\mathcal{P}_n^g). \tag{A.6}$$

Lemma 2, which proved the optimality of binding firm participation constraints, is not immediate in this setting. This is because transfers can affect the government participation constraint (equation A.5) if the marginal value of wealth is different across the government's inside and outside options. To simplify analysis as in the baseline model, we adopt an assumption of quasilinear utility to guarantee that the marginal value of wealth is the same across the inside and outside options. This assumption below replaces the assumption of homothetic preferences.

Assumption 1 *Each government n has quasilinear utility $U(C_n) = C_{n1} + \tilde{U}(C_{n,-1})$, where good 1 is a good not controlled by the hegemon.*

Quasilinear preferences also imply that transfers of wealth between consumers only shift consumption of good 1 across consumers, without changing other consumer expenditure patterns. This serves the same role as homothetic preferences did in the baseline model. As a consequence, Lemma 2 follows, and all firm participation constraints bind.

We are now ready to characterize the hegemon's optimal contract offered to firms and governments. As a preliminary, we denote ϕ_n to be the Lagrange multiplier on the participation constraint of government n.

Proposition 12 *Under an optimal contract:*

1. *The hegemon imposes on a foreign firm $i \in \mathcal{C}_m$, a wedge on input j given by*

$$\begin{aligned}\tau_{m,ij} = &-\frac{1}{1+\eta_i}\Bigg[\overbrace{\sum_{k\neq m}\phi_k\left(\frac{d\mathcal{U}_k^*}{dx_{ij}} - \frac{d\mathcal{U}_k^o}{dx_{ij}}\right)}^{\text{Building Power (Governments)}} + \overbrace{\sum_{k\in\mathcal{C}_m}\left(1+\eta_k\right)\left[\left(\frac{\partial\Pi_k}{\partial z} - \frac{\partial\Pi_k^o}{\partial z}\right)\frac{dz}{dx_{ij}} + \left(\frac{\partial\Pi_k}{\partial P} - \frac{\partial\Pi_k^o}{\partial P}\right)\frac{dP}{dx_{ij}}\right]}^{\text{Building Power (Firms)}}\Bigg] \\ &-\frac{1}{1+\eta_i}\Bigg[\underbrace{\sum_{k\in\mathcal{I}} X_{m,k}\frac{\partial p_k}{\partial P}\frac{dP}{dx_{ij}}}_{\text{Terms-of-Trade}} + \underbrace{\left[\sum_{k\in\mathcal{I}_m}\frac{\partial\Pi_k}{\partial z} + \frac{\partial u_m}{\partial z}\right]\frac{dz}{dx_{ij}}}_{\text{Domestic } z\text{-Externalities}} + \underbrace{\sum_{k\in\mathcal{I}_m}\tau_{m,k}\frac{d\boldsymbol{x}_k}{dx_{ij}}}_{\text{Private Distortion}}\Bigg]\end{aligned} \tag{A.7}$$

2. The hegemon demands a diplomatic action a_n of government n given by

$$0 = \frac{\partial \psi_m(a^*)}{\partial a_n^*} + \phi_n \frac{\partial \psi_n(a^*)}{\partial a_n^*} + \sum_{k \notin \{n,m\}} \phi_k \left(\frac{\partial \psi_k(a^*)}{\partial a_n^*} - \frac{\partial \psi_k(a_k^o, a_{-k}^*)}{\partial a_n^*} \right) \tag{A.8}$$

where a_k^o is government k's optimal action when rejecting the hegemon's contract.

The first part of Proposition 12 characterizes optimal input wedges demanded of firms by the hegemon. As in the baseline analysis, the hegemon uses wedges to build power over firms, to manipulate terms-of-trade, to correct domestic z-externalities, and to account for private distortions in the hegemon's economy. The new term in the tax formula relates to building power over foreign governments. In particular, the government internalizes how a shift in action shifts the equilibrium inside and outside options of each foreign government k. Similar to with firms, the hegemon seeks to manipulate the equilibrium in order to build its power over governments, by increasing their inside options and decreasing their outside options. The extend to which the government cares about expanding its power over government n is weighted by the Lagrange multiplier ϕ_n on that government's participation constraint, which represents the marginal value of power over that government.

The second part of Proposition 12 characterizes the optimal diplomatic action demanded of country n. The hegemon balances its own interests, the first term, against the power expended or built by asking a foreign government to change its action. As a consequence, the hegemon directly internalizes the inside option preferences of country n over the diplomatic action, weighted by the multiplier ϕ_n. Note that the absence of an effect on country n's outside option is precisely because country n is free to choose its diplomatic action at its outside option. The hegemon also internalizes the power consequences over all third party countries, and demands actions of country n that increase the inside options of other countries and decrease their outside options. In particular, the hegemon can have a stronger ability to coordinate countries onto its preferred diplomatic action if there are strategic complementarities in that action, since once a large fraction of countries are coordinated onto the action.

Optimal Anti-Coercion. The following proposition characterizes optimal anti-coercion policies adopted by governments that anticipate the hegemon attempting to influence both firms and governments.

Proposition 13 *The optimal domestic policy of country n satisfies*

$$\tau_n \frac{d\boldsymbol{x}_n^o}{d\tau_n} = -\left[\sum_{i \in \mathcal{I}_n} \frac{\partial \Pi_i^o}{\partial z} + \frac{\partial u_n}{\partial z} \right] \frac{dz}{d\tau_n} - X_n^o \frac{dP}{d\tau_n} - \frac{\partial \psi_n(a^*)}{\partial a^*} \frac{da^*}{d\tau_n} \tag{A.9}$$

Paralleling Proposition 3, the government engages in anti-coercion policies to improve the outside options of its firms that contract with the hegemon and to shift the equilibrium by manipulating the wedges that the hegemon sets ex post. In addition, the government accounts for how its anti-coercion policies shapes how the hegemon influences the diplomatic actions demanded of both its own countries and also of other countries, which is the new final term in equation A.9.

Global Planner and Noncooperative. Finally, we revisit the two key benchmarks of the global planner and the noncooperative outcome.

Global Planner: For the global planner to lack a redistributive motive, given quasilinear utility the welfare weights are $\Omega_n = 1$ (utilitarian). The global planner's optimal input wedges are given by equation (13) in Proposition 5, while the global planner's optimal actions satisfy

$$\sum_{k=1}^{N} \frac{\psi_k(a^*)}{\partial a_n} = 0.$$

The hegemon's optimal actions resemble the global planner's in the sense that the hegemon internalizes the effects of changes in actions on the inside options of governments due to their participation constraints, weighted by the multiplier ϕ_k. Unlike the hegemon, however, the global planner places no weight on reducing the outside options of governments that reject the hegemon's contract.

Noncooperative Equilibrium. In absence of hegemonic influence, each country sets its wedges according to Proposition 6. In addition, each government chooses its diplomatic action to maximize its own consumer's utility, that is

$$\frac{\partial \psi_n}{\partial a_n} = 0.$$

In comparison to the global planner, each individual country neglects the welfare consequences to other countries of its diplomatic action.

A.3.2 Bargaining Weights and Punishment Leakage

We provide a simple extension to the general theory in which the hegemon does not have full bargaining power ex post. We introduce a reduced-form bargaining weight $\mu \in [0, 1]$ and modify the participation constraint of firm i to be

$$V_i(\Gamma_i) \geq \mu V_i^o(\mathcal{J}_i^o) + (1 - \mu) V_i(\mathcal{J}_i). \tag{A.10}$$

That is, if $\mu = 1$ the hegemon has full bargaining power and can hold the firm to its outside option, while if $\mu = 0$ the firm has full bargaining power and the hegemon cannot extract any costly actions. One interpretation of equation A.10 is that $1 - \mu$ is the probability of leakage of punishments, that is the possibility that the firm will be able to evade the punishment and retain access to the hegemon-controlled inputs.

From here, we can define the modified outside option as $\mathcal{V}_i^o(\mathcal{J}_i^o) = \mu V_i^o(\mathcal{J}_i^o) + (1 - \mu) V_i(\mathcal{J}_i)$. Formal analysis then proceeds as before, with $\mathcal{V}_i^o$ replacing V_i^o. Given Lemmas 1 and 2, the transfer extracted is

$$T_i = V_i(\tau_m, \mathcal{J}_i) - \mathcal{V}_i^o(\underline{\mathcal{J}}_i^o).$$

As before, the hegemon has an incentive to maximize the gap between the inside option from accepting the contract and the outside option $\mathcal{V}_i^o$ that arises under the (probabilistic) punishment. The key difference from before is that the outside option $\mathcal{V}_i^o$ is a weighted average between the scenarios of punishment $V_i^o(\underline{\mathcal{J}}_i^o)$ and no punishment $V_i(\mathcal{J}_i)$. In the context of Proposition 1 (hegemon's optimal contract wedges), this means its building power motivation again orients around maximizing the inside option of firms and minimizing their outside option $\mathcal{V}_i^o$. Analogously, anti-coercion of countries revolves around maximizing their firms' outside options $\mathcal{V}_i^o$. The key difference from before is that in maximizing their outside option, country n weights both the case in which it is punished and cannot rely on the hegemon's inputs, but also (with probability $1-\mu$) the probability it retains access to the hegemon's inputs.

A.3.3 Punishments, Credibility, and Manipulating the Inside Option

We have modeled the hegemon as committing to carry out punishments against entities that reject its contract. If, in particular, an atomistic firm were to reject the contract, the hegemon would be able to carry out the punishment without incurring a loss of value because the equilibrium would not change. If we were to extend the model to a repeated game, with our baseline model being the stage game and punishments being for permanent exclusion from using hegemon-controlled inputs at all future dates, the hegemon could potentially gain credibility from the fact that it contracts with a cross-section of firms. In particular, if the hegemon were to fail to carry out a punishment against an individual entity that rejected its contract, other entities would also doubt its commitment to carry out punishments against them, limiting the hegemon's ability to extract costly actions of other entities. The hegemon would trade off the one-shot gain in value from not carrying out the punishment in the current stage game, against the loss in continuation value of its reduced power in the future. This would add a "incentive compatibility of punishments" constraint for the hegemon that would limit the costly actions it could demand. The limits to power this would imply would depend on, among other things, the number of players the hegemon contracts with. If as in the baseline model the hegemon contracts with continuums of atomistic agents, the one-shot gain would be infinitesimal while the continuation value loss would be potentially large, leading the punishment IC constraint to impose almost no limit. If instead the hegemon were to contract with a small number of large entities, the hegemon's stage game loss could potentially be large, leading to a more binding constraint.

Our baseline model has focused on the hegemon gaining power by threatening punishments that lower the outside option of entities that reject its contract. Another source of power is through increasing the inside option. The inside option can be increased, for example, if the hegemon serves as a global enforcer, coordinating joint threats for retaliation against entities that deviate on their promised economic relationships (Clayton et al. (2023)). This increases the scope for international economic activity by enhancing commitment, increasing the inside option. Following Clayton et al. (2023), we could extend our framework to accommodate joint threats as a source of power either by introduce a second period or through a repeated game, and by introducing the ability of firms to "cheat" or "steal" in their economic relationship. The key economic trade-off in our model would still revolve around the hegemon wanting to increase the inside option – of retaining access to the hegemon's commitment power – and also decreasing the outside option – of losing access to the hegemon's commitment power and, potentially, also to its inputs. Given the presence of side payments T_i as in the baseline model, the hegemon would hold firms to their participation constraints, leading countries to again maximize their outside option in which they have lost access to the hegemon's enforcement (and inputs).

A.3.4 Hegemon Commitment and International Organizations

In this appendix, we explore how the hegemon could potentially improve its welfare through commitments to how it will engage in coercion ex post. The hegemon tying its hands with such commitments could be valuable because it would influence how countries chose to engage in anti-coercion policies, potentially limiting fragmentation away from the hegemon's systems. One interpretation of such commitments is the setting up of international organizations, like the IFM or WTO, that seek to put constraints on policies adopted by countries. In the general setup, we can model instrument restrictions on both transfers T_i and on wedges τ_i. For example, the hegemon could commit to set a subset of wedges to zero, or could commit to only a partial extraction of surplus as transfers. For expositional simplicity, we focus on commitments over transfers for the general case. We then provide an example of a combination of transfer and wedge restrictions that the hegemon could use to improve its country's welfare in our application of Section 4.4.

A.3.4.1 Extending the General Setup

We model a simple commitment over transfers, that the hegemon will only extract a fraction μ of the gap between the inside and outside option as a transfer payment. Formally, this reflects the constraint to set the transfer

$$T_i = \mu\Big(V_i(\tau_m, \mathcal{J}_i) - V_i^o(\mathcal{J}_i)\Big),$$

where $\mu \in [0,1]$ reflects the hegemon's commitment (with $\mu = 1$ being the case of no commitment, as in Lemma 2). Firm i's profits from accepting the contract are therefore $V_i(\tau_m, \mathcal{J}_i) - \mu\Big(V_i(\tau_m, \mathcal{J}_i) - V_i^o(\mathcal{J}_i)\Big) = \mu V_i^o(\mathcal{J}_i^o) + (1-\mu)V_i(\tau_m, \mathcal{J}_i)$. Such a commitment from the hegemon could be valuable because it vests more of the inside option with country n, potentially reducing the motivation for anti-coercion policies. It closely resembles the bargaining weights of Appendix A.3.1.

Given a choice of μ, the hegemon's problem is identical to Proposition 1 except that the building power term is now weighted by μ. On the other hand, the ex ante objective of country n now becomes

$$\mathcal{U}_n = W_n(p, w_n) + u_n(z), \quad w_n = \sum_{i\in\mathcal{I}_n}\Big[\mu V_i^o(\underline{\mathcal{J}}_i^o) + (1-\mu)V_i(\tau_m, \mathcal{J}_i)\Big] + \sum_{f\in\mathcal{F}_n} p_f^\ell \bar{\ell}_f$$

As a result, the optimal wedges of country n's government parallel those of equation 9, except that government n now values the weighted average of its outside and inside option (similar to the case of bargaining weights). As a result, anti-coercion policy also directly loads on how changes in ex-ante wedges affect the hegemon's offered wedges, since those in turn affect the inside option $V_i(\tau_m, \mathcal{J}_i)$.

Hegemon's Optimal Commitment μ. Finally, we ask how a change in the transfer extracted μ affects the hegemon's welfare. Similar derivations to Proposition 1 yield

$$\begin{aligned}
\frac{1}{\frac{\partial W}{\partial w_m}}\frac{\partial \mathcal{U}_m}{\partial \mu} &= \overbrace{\sum_{i\in\mathcal{C}_m}\Big[\Pi_i(x_i^*) - \Pi_i(x_i^o)\Big]}^{\text{Direct Increase in Transfers}} \\
&\quad + \underbrace{\mu\Bigg[\sum_{i\in\mathcal{C}_m}\Big[(\tau_{m,i}+\tau_{n,i})\frac{dx_i^*}{d\mu} - \tau_{n,i}\frac{dx_i^o}{d\mu}\Big] + \sum_{i\in\mathcal{C}_m}\Big[\frac{\partial \Pi_i(x_i^*)}{\partial z} - \frac{\partial \Pi_i(x_i^o)}{\partial z}\Big]\frac{dz}{d\mu} + \sum_{i\in\mathcal{C}_m}\Big[\frac{d\Pi_i(x_i^*)}{dP} - \frac{d\Pi_i(x_i^o)}{dP}\Big]\frac{dP}{d\mu}}_{\text{Indirect Change in Transfers}} \\
&\quad + \underbrace{X_m\frac{dP}{d\mu}}_{\text{Terms-of-Trade}} + \underbrace{\Bigg[\sum_{i\in\mathcal{I}_m}\frac{\partial \Pi_i}{\partial z}\frac{dz}{d\mu} + \frac{\partial u_m}{\partial z}\Bigg]\frac{dz}{d\mu}}_{\text{Domestic z-Externalities}} + \underbrace{\sum_{i\in\mathcal{I}_m}\tau_{m,i}\frac{dx_i^*}{d\mu}}_{\text{Private Distortion}}
\end{aligned}$$

An increase in μ has three sets of effects. The first is to directly increase the transfers the hegemon is able to collect. The second is to indirectly change transfers by shifting the equilibrium. The third are the terms-of-trade, domestic z-externality, and private distortions that arise as the equilibrium shifts.

A.3.4.2 Value of Commitment in Section 4.4 Application

We now show how the hegemon in our Section 4.4 application can increase its own welfare through policy commitments that reduce the incentive for foreign countries to engage in anti-coercion. We provide a simple example of a commitment the hegemon could make to increase welfare, rather than looking for the optimal commitment. We simplify exposition by taking the limit $N \to \infty$, so that every non-hegemonic country is small and takes the productivity of the hegemon's system as given.

Suppose that the hegemon makes a commitment to both limit the extent of transfers, and also not to distort foreign firms' activities. Formally, the hegemon's commitments are: (i) to limit transfers to $T_i = \mu(V_i(\tau_m, \mathcal{J}_i) - V_i^o(\underline{\mathcal{J}}_i^o))$; and, (ii) to not impose wedges on foreign firms, $\tau_m = 0$. As a result, the hegemon's ex-post contract is fully specified and its transfer extracted is $T_i = \mu(V_i(\mathcal{J}_i) - V_i^o(\underline{\mathcal{J}}_i^o))$. Wedges set by country n can affect the equilibrium realization of z and the transfer T_i, but not the wedges τ_m (which are zero).

Consider the optimal policy of country n ex ante. Following the analysis above and given constant prices, country n sets wedges in order to maximize

$$\mu V_i^o(\underline{\mathcal{J}}_i^o) + (1-\mu)V_i(\mathcal{J}_i).$$

Following the proof of Proposition 9, we have

$$V_i^o(\underline{\mathcal{J}}_i^o) = \left[p_i \overline{A}_h^{\beta/\sigma}\left[\frac{p_i\beta}{p_h + \tau_{n,i_nh}}\left(\overline{A}_h^{1/\sigma}\right)^{\beta}\right]^{\frac{\beta}{1-\beta}} - p_h\left[\frac{p_i\beta}{p_h + \tau_{n,i_nh}}\left(\overline{A}_h^{1/\sigma}\right)^{\beta}\right]^{\frac{1}{1-\beta}}\right] z_{i_nh}^{\frac{\xi_h\beta}{1-\beta}}.$$

We also have

$$V_i(\mathcal{J}_i) = \Pi_i(x_i)$$

We argue that there is a value $\mu \in (0,1)$ such that the hegemon can extract a positive transfer, and so improve on the outcome when $\mu = 1$ (Proposition 9) when every foreign country imposed $\tau_{n,ij} \to \infty$. We denote this policy τ_n^{∞}. Let τ_n be any finite tax policy, then from the Inada condition taking aggregate productivity as given, for any $A_j > 0$) we have $V_i(\mathcal{J}_i)|_{\tau_n} > V_i^o(\underline{\mathcal{J}}_i^o)|_{\tau_n}$. Thus, T_i is positive for any finite tax policy τ_n.

Next, consider the limiting case $\mu = 0$, wherein the hegemon extracts no transfers. This is equivalent to the noncooperative equilibrium, so that country n sets $\tau_{n,i_nj}^{NC} = 0$ and $\tau_{n,i_nh}^{NC} = -\frac{\xi_h}{1+\xi_h}p_h$. We have $V_i(\mathcal{J}_i)|_{\tau_n^{NC}} > V_i(\mathcal{J}_i)|_{\tau_n^{\infty}} = V_i^o(\underline{\mathcal{J}}_i^o)_{\tau_n^{\infty}}$. Now, consider perturbing μ to $\mu = \epsilon$. By continuity, for sufficiently small ϵ we have

$$\epsilon V_i^o(\underline{\mathcal{J}}_i^o)|_{\tau_n^{NC}} + (1-\epsilon)V_i(\mathcal{J}_i)|_{\tau_n^{NC}} > \epsilon V_i^o(\underline{\mathcal{J}}_i^o)|_{\tau_n^{\infty}} + (1-\epsilon)V_i(\mathcal{J}_i)|_{\tau_n^{\infty}},$$

so that τ_n^{∞} is not an optimal policy at $\mu = \epsilon$ for sufficiently small ϵ. But then for sufficiently small ϵ we have $V_i(\mathcal{J}_i)|_{\tau_n^*} > V_i^o(\underline{\mathcal{J}}_i^o)|_{\tau_n^*}$, and therefore $T_i > 0$. Thus the hegemon can improve its own welfare with a commitment to $\tau_m = 0$ and $\mu = \epsilon$ for sufficiently small ϵ.

A.3.5 Application: CES Isomorphism

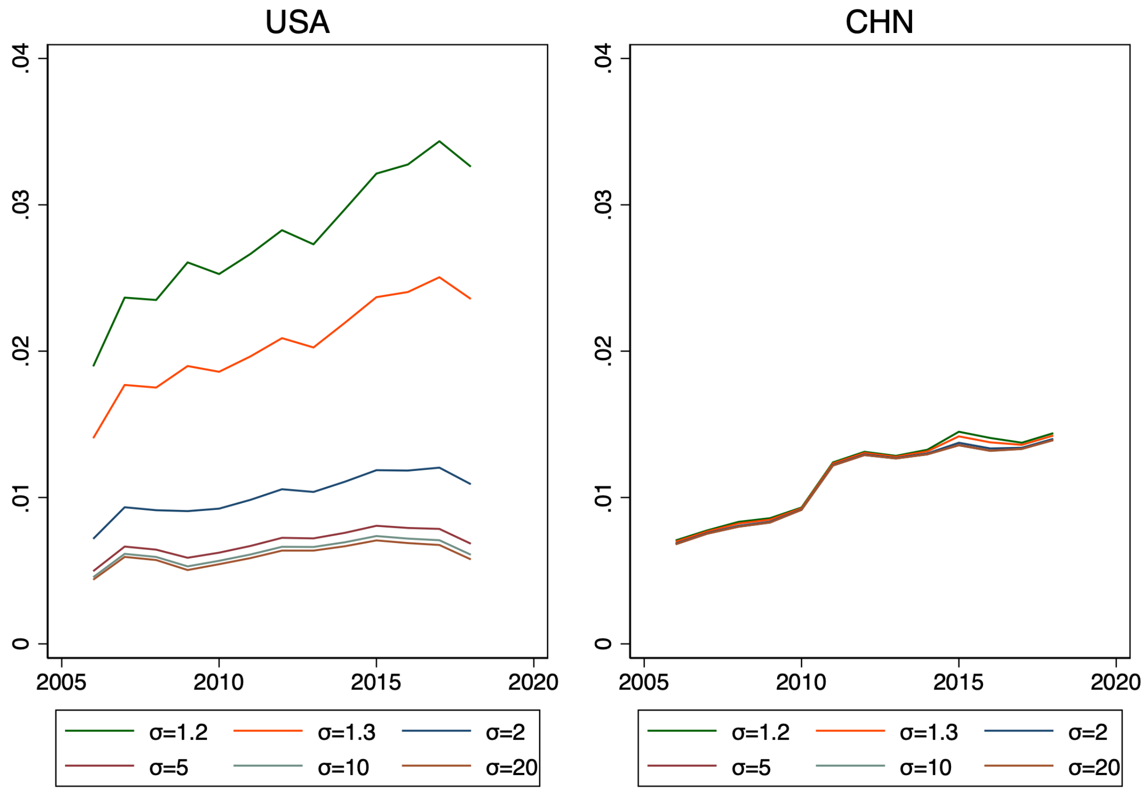
In this appendix we show how the constant expenditure share of our payments system application (Section 4.4) can be instead represented by a Cobb Douglas production function. In particular, suppose that the manufacturing sector instead had a production technology $f(x,\ell) = A(x_{di}^{\alpha}\ell_{dn}^{1-\alpha})^{\beta}$. Its profit function is therefore $p_d A(x_{di}^{\alpha}\ell_{dn}^{1-\alpha})^{\beta} - p_h\ell_{dn} - p_i x_{di}$. The firm's first order conditions imply $p_i x_{di} = \frac{1-\alpha}{\alpha} p_h \ell_{dn}$, meaning that expenditures on financial services are a constant fraction $\gamma = \frac{1-\alpha}{\alpha}$ of expenditures on the local factor. Given constant prices, we can substitute this solution into the profit function to obtain

$$p_d \hat{A} \ell_{dn}^{\beta} - (1+\gamma) p_h \ell_{dn},$$

where $\hat{A} = A\left(\frac{1-\alpha}{\alpha}\frac{p_h}{p_i}\right)^{\alpha}$ is the modified productivity (set equal to one for simplicity in the application).

A.4 Empirical Appendix

Figure A.1: Power and the Elasticity of Substitution of Finance



Notes: This figure plots the power calculation in Equation 18, aggregated to the global level weighted by country size for 6 different levels of the elasticity of substitution of financial services. The United States and China are dropped as target countries for this calculation.