A Theory of Economic Coercion and Fragmentation

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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. Mechanisms that generate gains from integration, such as external economies of scale and specialization, also increase the hegemon's power because in equilibrium they make other relationships poor substitutes for those with a global hegemon. Other countries can implement economic security policies to shape their economies in order to insulate themselves from undue foreign pressure. Countries considering these policies face a tradeoff between gains from trade and economic security. While an individual country can make itself better off, uncoordinated attempts by multiple countries to limit their dependency on the hegemon via economic security policies lead to inefficient fragmentation of the global financial and trade system. We study financial services as a leading application both as tools of coercion and an industry with strong strategic complementarities. We estimate that U.S. geoeconomic power relies on financial services, while Chinese power relies on manufacturing. Since power is nonlinear and increases disproportionally as the hegemon approaches controlling the entire supply of a sectoral input, we estimate that much economic security could be achieved with little overall fragmentation by diversifying the input sources of key sectors currently controlled by the hegemons.

Keywords: Geoeconomics, Geopolitics, Anti-Coercion Policy, Industrial Policy, Economic Security, Economic Statecraft, Payment Systems, Dollar Diplomacy.

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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 U.S. or China. They worry about 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 economic-security 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 U.S. 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 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. We show that 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 demonstrate 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. 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. 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. The hegemon country in our model is special in both being the only country that moves second in the Stackelberg timing and in being able to make threats and coerce foreign entities (i.e. offer the hegemonic contract). This set-up provides a theoretical foundation for the broad hegemonic powers exerted by countries such as the U.S. and China as well as an ex-ante policies that smaller countries adopt in attempting to insulate themselves.

Since 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 as in Clayton, Maggiori and Schreger (2023). 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 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 inputs 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.

A view from the political science literature is that hegemonic countries establish and utilize international organizations to set rules that improve their own welfare (Baldwin (1985)). We show in our model that the hegemon values rules even if they only constrain its own behavior. By limiting its own ability to engage in economic coercion, the hegemon disincentivizes other countries from adopting economic security policies. In the presence of cross-country externalities, each country reduces its own economic security policies without taking into account the effect on other countries. As a result, the hegemon extracts surplus as other countries collectively over rely on the commitments made by international organizations. In our model, the liberal world order is a particular expression of economic statecraft.

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 heavy use of American 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 U.S. coercion, but also as a means to offer an alternative to other countries that might fear U.S. 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 intermediaries in a country can use both a domestic financial service and also a global one provided by the hegemon in order to provide intermediation services to domestic manufacturers. 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 intermediaries 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 intermediaries to shift away from their domestic alternative and towards the hegemon's global services. The hegemon thus coordinates global financial integration and induces intermediaries 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 takes the form of a nested constant elasticity of substitution (CES) function, the power of the hegemon over a country can be measured with a simple ex-ante sufficient statistic. This statistic requires estimating in the data the sectoral expenditure shares on domestic and foreign inputs, which can be readily done with input-output tables and bilateral trade data at the sectoral level, and the elasticity of substitution among various inputs. We estimate this power measure at the country level for the United States and China and for broader coalitions of countries led by these two hegemons. For plausible ranges of the elasticity of substitution, we find that financial services are an important source of American geoeconomic power. This contrasts sharply with China, for which almost all geoeconomic power arises from manufacturing.

We highlight a nonlinearity in power generation that is both theoretically interesting and of practical policy relevance. All else equal, power increases disproportionally as the hegemon approaches controlling the entire supply of a sectoral input. In this sense, the difference between controlling 95 percent and 85 percent of an input is enormous, because for a medium sized target economy that extra 10 percent offers a viable alternative to withstand coercion by the hegemon. We show that, in practice, the coalition of countries aligned with the U.S. controls extremely high shares of global financial services, often in excess of 80 or 90 percent for many target countries. This almost complete control of the world financial architecture accounts for the frequent use of finance as a mean of coercion by the U.S.-led coalition.

From the perspective of the hegemon, the nonlinear nature of power cautions against overusing it and triggering anti-coercion policies and fragmentation in response. From the perspective of other countries, the nonlinearity can be used to identify inputs, often called "choke points" or critical dependencies, for which even a minor amount of diversification can generate a large decrease in the hegemon's coercive ability. For example, while it is easy to dismiss short-run scenarios in which China and other BRICS countries can provide an alternative financial architecture that rivals the U.S. coalition one, it is far from obvious that this alternative architecture could not account for 10-15 percent of world expenditures on international financial services.[2] Our analysis reveals that most of the losses to U.S. power would come from this alternative going from 1 to 10 percent, not from the next 40 percentage point increases. To illustrate this point in the data, we focus on the economic security policies Russia instituted after its invasion of Crimea in 2014. Anticipating the possibility of future U.S.-led sanctions, Russia actively reduced its financial dependence on the U.S.-led coalition. As a consequence, we estimate that the U.S.-led coalition's financial power over Russia was approximately halved by 2021 compared to 2014. This large loss in power is in part responsible for the muted effect of the financial sanctions that the American Coalition imposed after 2022 since Russia, via its ex-ante policies, had already prepared some alternatives.

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). Hirschman (1945) emphasized the dependencies that arise when trade is concentrated with a few large partners and put forward an index, later known as the Herfindahl-Hirschman index, to measure the concentration. Kindleberger (1973), Gilpin (1981), and Keohane (1984) introduced the idea of 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. Kirshner (1997), Gavin (2004), and Cohen (2015, 2018) focus specifically on the interplay between the monetary system and geopolitics. Blackwill and Harris (2016), Farrell and

[2] See the 2024 Kazan Declaration by BRICS countries and related Russian report.

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), Konrad (2024), Kleinman et al. (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 and the size of production externalities see Ottonello, Perez and Witheridge (2023), Liu (2019), Bartelme, Costinot, Donaldson and Rodriguez-Clare (2019), Juhász et al. (2022), Juhász et al. (2023), and Farhi and Tirole (2024). In particular, Farhi and Tirole (2024) develop a model of industrial financial policy. 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 Eaton and Engers (1992); 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). McLaren (1997) models how countries make ex-ante investments to improve their position in negotiations to prevent a trade conflict. Berger, Easterly, Nunn and Satyanath (2013) demonstrate that countries where the CIA intervened during the Cold War imported more from the United States. Antràs and Miquel (2023) explore how foreign influence affects tariff and capital taxation policy. We also relate to the literate on whether closer trade relationships promote peace (Martin, Mayer and Thoenig (2008, 2012)). From capital controls and terms of trade manipulation Farhi and Werning (2016), Costinot et al. (2014), Sturm (2022).

Our paper also contributes to a growing empirical literature exploring the relationship between geopolitics and fragmentation of global trade and investment by providing a framework for structural gravity analysis (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)).

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 financial 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 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 $P = (p, p^{\ell})$.

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) and/or direct political objectives. We simplify the analysis by assuming that the consumption utility function U is homothetic and identical across countries.[3] We also assume U is increasing, concave, and continuously differentiable. Consumers take z and P as given. The representative consumer in each country n owns all domestic firms and local factor endowments, and so 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 a subset $\mathcal{F}_{in}$ of the local factors of country 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, $\ell_i = \{\ell_{if}\}_{f\in\mathcal{F}_{in}}$ 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 and prices P as given. We 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. The dependency of f_i on the vector of

[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.

[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.

aggregates z captures production externalities (see below). Firms in this model are best thought of as entities that perform an economic activity, for example manufacturers, wholesalers, and financial intermediaries. They can be private entities or can be owned and operated 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

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

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 Aggregates. 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 from the aggregate vector z 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. Bartelme, Costinot, Donaldson and Rodriguez-Clare (2019) and Ottonello, Perez and Witheridge (2023) estimate sizable economies of scale.

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 $f_i(\ell_i) = \sum_{f \in \mathcal{F}_n} \frac{1}{\tilde{p}_i} \tilde{p}_f^{\ell} \ell_{if}$. 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 $p_f^{\ell} = \tilde{p}_f^{\ell}$.*[5]

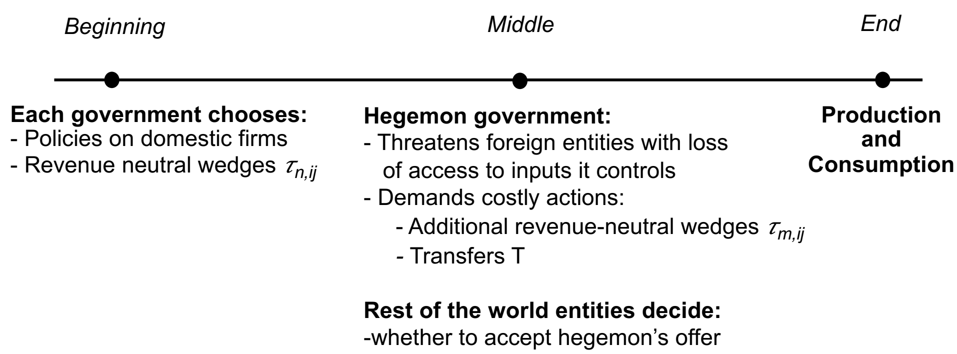
[5]For example, we can guarantee this by assuming consumers and the factor-only firms can short goods and factors.

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

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 exogenously taken to be a world hegemon that can also seek to impose policies on foreign entities. 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. The hegemon is special in being the only country that imposes policies in the second part of the Stackelberg game.[6]

Figure 1: **Timeline**



Notes: Model timeline.

Each country's government has policy instruments that consist of a complete set of revenue-neutral wedges $\tau_{n,i} = \{\{\tau_{n,ij}\}_{j\in\mathcal{J}_i}, \{\tau^{\ell}_{n,if}\}_{f\in\mathcal{F}_{in}}\}$ 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 $\tau^{\ell}_{n,if}$ 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 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.[7]

[6]One could consider multiple hegemons competing in this second part of the game and/or the endogenous emergence of hegemons. Both are beyond the scope of this paper that takes the existence of one hegemon as given and studies the equilibrium implications.

[7]In this setup, we have not allowed countries (or the hegemon) to impose bilateral export tariffs on sales, with infinite tariffs imitating severing a relationship. It is straightforward to extend the model to allow for such instruments. Since revenue remissions are taken as given, an off-path country n policy change can

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 government policies 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.[8] 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. Since the hegemon lacks legal jurisdiction over foreign entities, the hegemon enforces compliance with its demands for costly actions by threatening to exclude a foreign entity from buying a subset of inputs if that entity does not comply. We focus in the main text on the hegemon pressuring foreign firms. Appendix A.3.1 extends our analysis to allow the hegemon to pressure other governments.

We assume that the hegemon can contract with every foreign firm that is able to source 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 $\tau_{m,i} = \{\{\tau_{m,ij}\}_{j \in \mathcal{J}_i}, \{\tau^{\ell}_{m,if}\}_{f \in \mathcal{F}_{in}}\}$ 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.

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

lead to nonzero net revenues collected by another government from its domestic sectors. We assume these revenues are remitted to that country's consumer.

[8] 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.

that the hegemon contracts with. This avoids unrealistic situations in which the punishment of the hegemon occurs over arbitrarily long supply chains of foreign entities. Formally, a punishment $\mathcal{J}_i^o$ is *feasible* if $\mathcal{J}_i \backslash (\mathcal{I}_m \cup \mathcal{C}_m) \subset \mathcal{J}_i^o$. We define $\underline{\mathcal{J}}_i^o = \mathcal{J}_i \backslash (\mathcal{I}_m \cup \mathcal{C}_m)$ 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.[9] The inclusion of foreign entities in the set of firms enacting the punishment is of practical relevance since the U.S., for example, often uses foreign banks or technology companies with strong economic ties to the U.S. economy in enacting its punishments.

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 Γ_i, it does not have to comply with the hegemon's demands but is punished by losing access to inputs controlled by the hegemon, achieving value:

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

We use the superscript o to denote values of objects at the outside option. For example, (x_i^o, ℓ_i^o) are 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

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

which implicitly defines the optimal allocations (x_i^*, ℓ_i^*) as a function of the contract offered.[10]

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

$$V_i(\tau_m, \mathcal{J}_i) - T_i \geq V_i^o(\mathcal{J}_i^o). \tag{3}$$

The participation constraint is crucial to understanding the economics of hegemonic power over

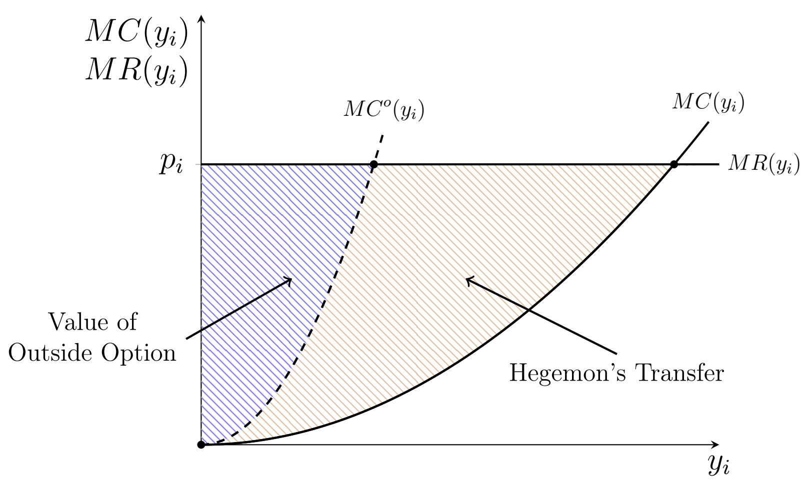
[9]The hegemon is willing to punish an individual atomistic firm that deviates off-path since exclusion of an atomistic firm does not change the equilibrium, meaning the hegemon loses no value by doing so. As we discuss in Appendix A.3.3, credibility can also arise because punishing one deviator can help to maintain credibility for carrying out punishments of other potential deviators (in a repeated game).

[10]Noting that $V_i(\Gamma_i) = V_i(T_i, \tau_{m,i}, \mathcal{J}_i) = V_i(0, \tau_{m,i}, \mathcal{J}_i) - T_i$, we slightly abuse notation by writing $V_i(0, \tau_{m,i}, \mathcal{J}_i) = V_i(\tau_{m,i}, \mathcal{J}_i)$. Recall also that the hegemon takes the revenue remissions of country n's government as given. In equation 2, these remissions are given by $\sum_{j \in \mathcal{J}_i} \tau_{n,ij} x_{ij}^* + \sum_{f \in \mathcal{F}_{in}} \tau_{n,ij}^\ell \ell_{if}^*$.

foreign entities. 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 is in contrast with Clayton et al. (2023), which studies joint threats as a way for the hegemon to generate slackness in the constraint by increasing the inside option. 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 by determining the total private cost to the firm of the actions that the hegemon can demand.

From this perspective, strategic sectors for the hegemon are those that increase its power, that is that would cause the largest losses for targeted entities were they to be cut off. As we quantify 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.

Figure 2: Hegemon's Power Building Motives



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

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

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 $T \geq 0$.

Our model allows for a sharp characterization of the off-path punishments that the hegemon threatens. Intuitively, the hegemon always threatens the largest punishment possible to maximize its power over foreign firms. 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. We start by proving every participation constraint binds, resulting in a trade-off between demands for transfers and wedges.

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. 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 $MC^o(y_i)$, reflecting the higher marginal cost of production arising from loss of access to the hegemon-controlled 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 firm's inside 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 profits at the outside option.[11]

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 them into the hegemon's problem and keep track of the Lagrange multiplier η_i on the transfers non-negativity constraint: $T_i = V_i(\tau_m, \mathcal{J}_i) - V_i^o(\underline{\mathcal{J}}_i^o) \geq 0 \quad \Rightarrow \quad V_i(\tau_m, \mathcal{J}_i) \geq V_i^o(\underline{\mathcal{J}}_i^o)$.

[11]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 $V_i(\tau_m, \mathcal{J}_i) - T_i \geq V_i^o(\mathcal{J}_i^o) + (1-\mu)(V_i(\mathcal{J}_i) - V_i^o(\mathcal{J}_i))$, where $1-\mu$ 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 at outside option vs difference between inside and outside option profits).

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*

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

where $\boldsymbol{x}_i = (x_i, \ell_i)$, $\frac{d\boldsymbol{x}_k}{dx_{ij}} = \frac{\partial \boldsymbol{x}_k}{\partial z}\frac{dz}{dx_{ij}} + \frac{\partial \boldsymbol{x}_k}{\partial P}\frac{dP}{dx_{ij}}$, and where X_m is the vector of exports 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 (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 non-negativity 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.

To provide more intuition and illustrate the effect on quantities, we can specialize the theory for a moment by assuming constant prices as in the environment of Definition 1. Then, equation (5) reduces to

$$\tau_{m,ij} = -\frac{1}{1+\eta_i}\left[\left[\underbrace{\sum_{k\in\mathcal{C}_m}\left(1+\eta_k\right)\left(\frac{\partial \Pi_k}{\partial z}-\frac{\partial \Pi_k^o}{\partial z}\right)}_{\text{Building Power}}+\underbrace{\sum_{k\in\mathcal{I}_m}\frac{\partial \Pi_k}{\partial z}+\frac{\partial u_m}{\partial z}\right]}_{\text{Domestic } z\text{-Externalities}}\frac{dz}{dx_{ij}}+\underbrace{\sum_{k\in\mathcal{I}_m}\tau_{m,k}\frac{d\mathbf{x}_k}{dx_{ij}}}_{\text{Private Distortion}}\right] \tag{6}$$

The marginal benefit grouped under the label "Building Power" tracks how changes in equilibrium quantities ($\frac{dz}{dx_{ij}}$) affect how much power the hegemon has over foreign entities. The hegemon has more power if the induced equilibrium changes *raise* a firm's inside option ($\partial\Pi_k > 0$) or *lower* 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 entities 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.

The rest of the marginal benefits in the second line of equation 6 are more conventional optimal policy terms. The first 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 term $\partial\Pi_k$).

Further, the hegemon might have geopolitical considerations (the term ∂u_m originating from the utility function), that lead it to want to shrink a foreign activity, such as military expenditures on research, that directly threatens its utility. The third term, "private distortion," reflects the interaction between the induced equilibrium changes and domestic wedges that the hegemon placed on its own firms in the ex-ante stage, and so accounts for the loss of profits to its domestic firms whose production decisions are distorted away from their private optimum.

Returning to the general theory in equation 6, the extra terms trace the effects due to changes in prices ($\frac{dP}{dx_{ij}}$). These price changes affect both the building power motive and also have a standard "Terms-of-Trade" manipulation motive to boost prices of goods the hegemon exports ($X_{m,k} > 0$) and lower prices of goods it imports. Interestingly, these two objectives do not have to be aligned: the hegemon might be better off lowering prices of its exports in order to build more power.

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 $n \neq m$ has several 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.

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

$$\mathcal{U}_n = W(p, w_n) + u_n(z), \qquad w_n = \sum_{i \in \mathcal{I}_n} V_i^o(\underline{\mathcal{J}}_i^o) + \sum_{f \in \mathcal{F}_n} p_f^\ell \bar{\ell}_f. \tag{7}$$

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.

Input-Output 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*

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

$$\frac{dP}{de} = \Psi^P \left(\frac{\partial ED}{\partial e} + \frac{\partial ED}{\partial z^*} \Psi^z \frac{\partial x}{\partial e} \right) + \Psi^P \left(\frac{\partial ED}{\partial \tau_m} + \frac{\partial ED}{\partial z^*} \Psi^z \frac{\partial x}{\partial \tau_m} \right) \frac{d\tau_m}{de} \tag{9}$$

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 (8) 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 augmented in general equilibrium as 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.

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

When prices are not constant, amplification in equation (8) also occurs as a result of changes in prices inducing changes in firms' demand. Parallel to equation (9), 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:*

$$\tau_n \frac{d\boldsymbol{x}_n^o}{d\tau_n} = -\left[\sum_{i \in \mathcal{I}_n} \frac{\partial \Pi_i^o}{\partial z} + \frac{1}{\frac{\partial W_n}{\partial w_n}} \frac{\partial u_n}{\partial z} \right] \frac{dz}{d\tau_n} - X_n^o \frac{dP}{d\tau_n} \tag{10}$$

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 options.

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 marginal cost of a change in wedges is given by the private cost of distorting production from its private optimum, τ_n, times the amount that production is further distorted 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 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

$$\tau_n \frac{d\mathbf{x}_n^o}{d\tau_n} = -\Bigg[\underbrace{\sum_{i \in \mathcal{I}_n} \frac{\partial \Pi_i^o}{\partial z} + \frac{\partial u_n}{\partial z}}_{\text{Marginal Value of Change in Quantities}} \Bigg] \Bigg[\underbrace{\Psi^z \frac{\partial x}{\partial \tau_n}}_{\text{Standard Intervention}} + \underbrace{\Psi^z \frac{\partial x}{\partial \tau_m} \frac{d\tau_m}{d\tau_n}}_{\text{Anti-Coercion}} \Bigg], \tag{11}$$

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. Country n wants to manipulate z-externalities to bolster its firms' outside options (Π_i^o) or benefit its consumers (u_n). For example, country n might push its own firms to scale up domestic production in industries with economies of scale. This force features prominently in our application in Section 4.

[13]Proposition 3 provides necessary conditions for optimality.

The shift in equilibrium quantities in equation 11 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's 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's 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:

$$\tau_n \frac{d\mathbf{x}_n^o}{d\tau_n} = \underbrace{-X_n^o \frac{dP}{d\tau_n}}_{\text{Terms of Trade Manipulation}} \tag{12}$$

The government of country n is now imposing wedges on its firms to manipulate the terms of trade. From Proposition 9 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 U.S. 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 coercive 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*

$$\begin{aligned}\tau_{m,ij} = &- \overbrace{\sum_{k\in\mathcal{C}_m}\left(1+\frac{1}{\frac{\partial W_m}{\partial w_m}}\eta_k\right)\left[\left(\frac{\partial \Pi_k}{\partial z}-\frac{\partial \Pi_k^o}{\partial z}\right)\frac{dz}{dx_{ij}}+\left(\frac{\partial \Pi_k}{\partial P}-\frac{\partial \Pi_k^o}{\partial P}\right)\frac{dP}{dx_{ij}}\right]}^{\text{Building Power}} \\ &\underbrace{-\left[\sum_{k\in\mathcal{I}_m}\frac{\partial \Pi_k}{\partial z}+\frac{1}{\frac{\partial W_m}{\partial w_m}}\frac{\partial u_m}{\partial z}\right]\frac{dz}{dx_{ij}}}_{\text{Domestic } z\text{-Externalities}} - \underbrace{X_m\frac{dP}{dx_{ij}}}_{\text{Terms-of-Trade}}\end{aligned} \tag{13}$$

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 build its power by manipulating the global equilibrium (Proposition 1). However, the effect in the first line of equation (13) is ex-ante and operating through the activities of the hegemons' domestic firms.[14]

[14] In contrast with the anti-coercion motivation of foreign countries, equation 13 does not contain terms related to the reoptimization of the hegemon's contract, a consequence of Envelope Theorem. Rather, the hegemon internalizes how its domestic policies affect its contracting problem through the effects on its power over foreign firms.

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 (13) 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 inputs 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 U.S. hegemon and its provision of financial services to the rest of the world.

3.3 Efficient Allocation and Noncooperative Outcome

We benchmark our results against two relevant cases: first, the global planner's solution, which provides an efficiency benchmark; second, the noncooperative outcome that would arise if all countries were able to set domestic policies, but no country was 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:

$$\mathcal{U}^{GP} = \sum_{n=1}^{N} \Omega_n \Big[W_n(p, w_n) + u_n(z) \Big], \tag{14}$$

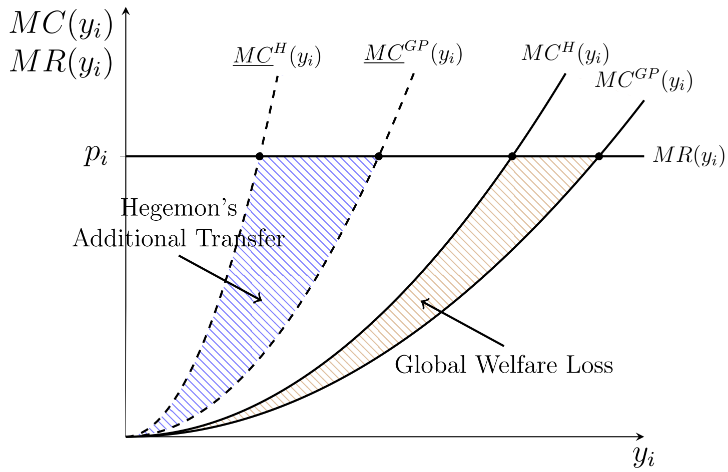
where $\Omega_n > 0$ is the Pareto weight attached to country n. As is common in the literature, we eliminate the motivation for cross-country wealth redistribution by choosing Pareto weights that equalize the marginal value of wealth across countries, that is $\Omega_n \frac{\partial W_n}{\partial w_n} = 1$. For the planner, the hegemon's ex-post wedges are redundant given the availability of all governments' ex-ante wedges and transfers are purely redistributive. We can, therefore, consolidate the planner's problem into a single stage in which it sets wedges τ on all sectors globally to maximize global welfare (equation 14). The following proposition characterizes the global planner's optimum.

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

$$\tau_{ij} = -\sum_{k \in \mathcal{I}} \frac{\partial \Pi_k}{\partial z_{ij}} - \sum_{n=1}^{N} \frac{1}{\frac{\partial W_n}{\partial w_n}} \frac{\partial u_n}{\partial z_{ij}} \tag{15}$$

The global planner uses wedges τ_{ij} to correct externalities arising from the vector of aggregate

Figure 3: Global Planner and Hegemon Equilibria



quantities z, differing from individual countries' optimal ex-ante policies in three ways. First, since the global planner lacks a redistributive motive, the global planner does not engage in terms-of-trade manipulation (at best zero-sum redistribution). Second, whereas individual country governments only target externalities borne by domestic firms and consumers, the global planner accounts for externalities on 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 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 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

[15] Whereas individual countries' wedge formulas account for network amplification, the global planner's wedges do not. Intuitively, the global planner has a complete set of instruments on all firms and can directly manage externalities associated with each activity separately. In contrast, individual countries and the hegemon have limited instruments, and can only control a subset of firms in the global economy. Although the global planner accounts for amplification through price changes, the resulting pecuniary externalities are purely redistributive and so do not generate a net welfare impact.

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. As a consequence, however, the hegemon 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, thus 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 further study this possibility in the application of Section 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 corrects z-externalities that fall on its domestic economy and manipulates its terms-of-trade. However, unlike anti-coercion against a hegemon that focused on the outside option, the government of country n now maximizes 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 off by destroying the gains from global integration. Indeed, our application in Section 4 proves a case in which the noncooperative equilibrium without a hegemon would have been welfare improving for all non-hegemonic countries.

3.4 A Hegemonic View of International Organizations

In this subsection, we explore how the hegemon could potentially improve its welfare through commitments that limit its ability to coerce foreign entities. A commitment to tie its own hands affects how other countries set anti-coercion policies, potentially reducing fragmentation away from the hegemon's economy. One interpretation of such commitments is the establishment of international organizations, like the IMF or WTO, that place constraints on the policies countries can adopt.

We study commitments in the form of restrictions on both transfers T_i and on wedges τ_i that the hegemons can make at the very start of the model. We model a commitment over transfers as a restriction to extract only a fraction $1-\mu_i \in [0,1]$ of the gap between the inside and outside option, that is to set $T_i = (1-\mu_i)(V_i(\tau_m, \mathcal{J}_i) - V_i^o(\mathcal{J}_i))$. As the hegemon raises μ_i, it leaves more surplus with foreign entities. Economically, this restriction is similar to vesting some of the bargaining power with entities (see Appendix A.3.2). We model a commitment over wedges as bounds placed on their use, $\tau_{m,ij} \in [\underline{\tau}_{m,ij}, \overline{\tau}_{m,ij}]$ (and similarly for factor wedges). For example, $\underline{\tau}_{m,ij} = \overline{\tau}_{m,ij} = 0$ is a commitment not to use the instrument.

For expositional simplicity, we focus in the general setup on optimal commitments over transfers. Suppose that the hegemon has committed to $\mu_i \in [0,1]$, then firm i's profits from accepting the contract are $V_i^o(\mathcal{J}_i^o) + \mu_i(V_i(\tau_m, \mathcal{J}_i) - V_i^o(\mathcal{J}_i^o))$. The hegemon now only receives a share $1-\mu_i$ of the gap between firm i's inside and outside option, and the hegemon's ex-post problem is identical to Proposition 1 except that the building power term is now downeighted by the share μ_i of surplus that accrues to the firm. This dampens the hegemon's power building motives and therefore affects the optimal wedges. On the other hand, country n now sets domestic wedges trading off maximizing the surplus it retains on the inside option with keeping a high outside option value, that is country n now maximizes the objective:

$$\mathcal{U}_n = W(p, w_n) + u_n(z), \quad w_n = \sum_{i \in \mathcal{I}_n} \left[V_i^o(\underline{\mathcal{J}}_i^o) + \mu_i(V_i(\tau_m, \mathcal{J}_i) - V_i^o(\mathcal{J}_i^o)) \right] + \sum_{f \in \mathcal{F}_n} p_f^\ell \overline{\ell}_f.$$

As a result, the optimal wedges of country n's government parallel those of equation 10, except that government n now maximizes a weighted average of the outside and inside options. The country's optimal policies $\tau_n(\mu)$, become a function of the hegemon's commitments to transfer extraction $\mu = \{\mu_i\}$. The proposition below characterizes the hegemon's optimal choice of μ_i.[16]

[16]The proposition is written assuming that $\mu_i^* < 1$, that is the optimal choice of μ_i is not to extract no transfers. The case $\mu_i^* = 1$ is covered by reversing the inequality in equation 16.

Proposition 7 *The hegemon's optimal choice of commitments μ_i satisfies*

$$\overbrace{\Pi_i - \Pi_i^o}^{\text{Lost Transfers}} \geq \overbrace{\sum_{k\in\mathcal{C}_m}(1-\mu_k)\left[\left(\frac{\partial \Pi_k}{\partial z}-\frac{\partial \Pi_k^o}{\partial z}\right)\frac{dz}{d\mu_i}+\left(\frac{d\Pi_k}{dP}-\frac{d\Pi_k^o}{dP}\right)\frac{dP}{d\mu_i}+(\tau_{m,k}+\tau_{n,k})\frac{d\boldsymbol{x}_k^*}{d\mu_i}-\tau_{n,k}\frac{d\boldsymbol{x}_k^o}{d\mu_i}\right]}^{\text{Increase in Power}}$$
$$+\underbrace{X_m\frac{dP}{d\mu_i}}_{\text{Terms-of-Trade}}+\underbrace{\left[\sum_{k\in\mathcal{I}_m}\frac{\partial \Pi_k}{\partial z}+\frac{\partial u_m}{\partial z}\right]\frac{dz}{d\mu_i}}_{\text{Domestic z-Externalities}}+\underbrace{\sum_{k\in\mathcal{I}_m}\tau_{m,k}\frac{d\boldsymbol{x}_k^*}{d\mu_i}}_{\text{Private Distortion}} \qquad (16)$$

When deciding the fraction μ_i of surplus to leave to a foreign firm, the hegemon trades off the direct loss in transfers (LHS) against the indirect benefits of deterring adoption of anti-coercion policies (RHS). Getting other countries to reduce anti-coercion measures can benefit the hegemon by increasing its power through shifts in the general equilibrium, by improving its terms of trade, by shifting z-externalities to favor its domestic economy, or by reducing private distortions domestically from its policies. It is both noteworthy and intuitive that it is only valuable to set $\mu_i > 0$ if it induces a beneficial endogenous response of other country's anti-coercion policies: if other countries had fixed policies, the hegemon's optimum would be full extraction ($\mu = 0$). More broadly, this suggests that the hegemon is willing to leave more surplus to countries the more those countries would otherwise employ economic security policies to mitigate hegemonic coercion. Interestingly, this endogenously produces the potential for differentiation in the surplus the hegemon is willing to leave to different countries in the world that is distinct from a more direct geopolitical classification of the allied and non-allied countries of the hegemon (e.g., UN voting similarities). For example, the hegemon may be willing to leave more surplus to a country for which deterring anti-coercion policies has particularly strong network propagation that increases the hegemon's power over other countries.

Our theory highlights that the hegemon can benefit from a rules based international order – even rules that only apply to itself – because those rules provide commitment power that limit motives of other countries to engage in economic security policies that reduce their dependency on the hegemon. This echoes a view from political science that international organizations are the expression of great powers and serve to improve the welfare of these dominant countries (Baldwin (1985)) and the analysis of Bagwell and Staiger (2004) of the incentives of large countries to sponsor trade agreements even if they limit their ability to manipulate the terms of trade. Although our formal characterization has focused on direct extraction μ, parallel trade offs would emerge for restrictions on instruments τ_m: the hegemon trades off the direct loss from being able to use the instrument, against the indirect benefits from favorably shaping the global equilibrium by reducing anti-coercion policies. While we have focused on the hegemon voluntarily imposing restrictions on itself, it could potentially do even better by enlisting other countries to agree to a set of rules that directly limit the ex-ante policies that are allowed. For example, the hegemon could induce agreement to its rules by offering favorable terms $\mu > 0$ to countries that forego use of certain instruments (such as tariffs on the hegemon's goods). The hegemon could potentially benefit from doing so because each country would only internalize its own surplus from agreeing to the terms, while neglecting the effects of its doing so on the power the hegemon had over other countries. Such outcomes are reminiscent of the view that a liberal world order can be an expression of economic statecraft rather than the absence of economic statecraft (Baldwin (1985)).

4 Financial Power and Fragmentation

We study a leading 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 U.S. 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.[17]

Bartlett and Ophel (2021) emphasize the crucial role of the U.S. dominance in financial services in exerting influence over foreign entities and activities that involve no direct U.S. role. Traditionally, sanctions involve legal actions over activities that include at least one U.S. entity or over which the U.S. 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)).[18]

[17] For example, in a report assessing the feasibility of U.S. 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)).

[18] 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

Our model captures these crucial elements of U.S. 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 U.S. financial services to induce the foreign entity to voluntarily comply with its requests. For example, the U.S. 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 U.S. 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 its founder).[19]

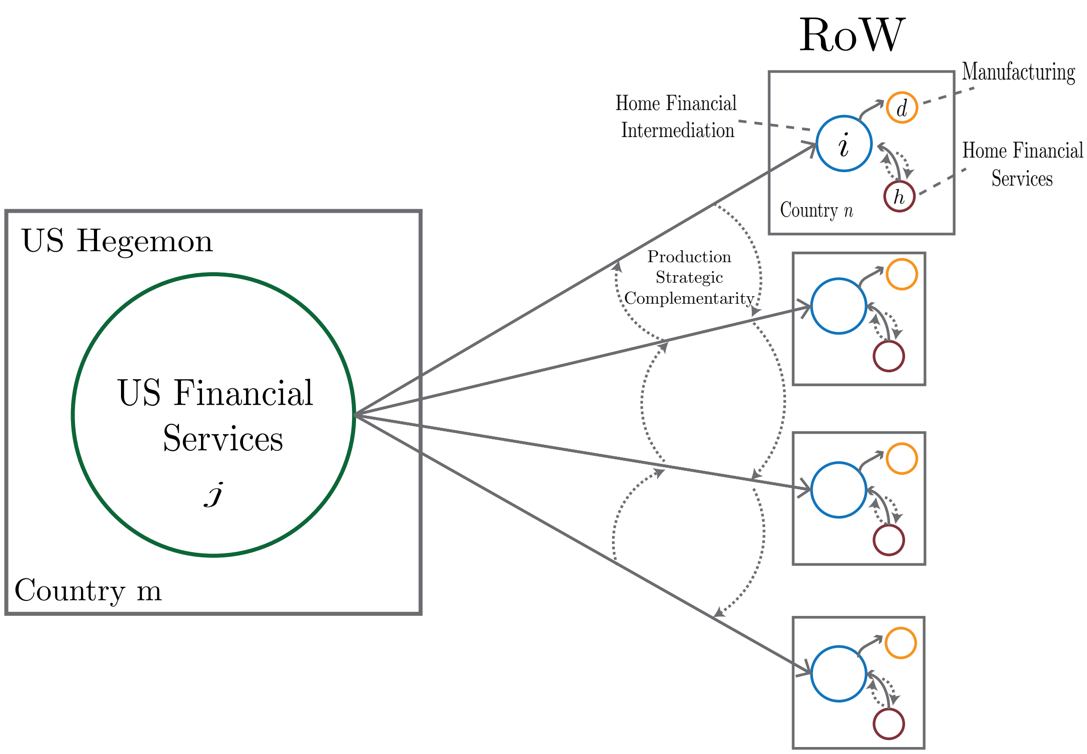
Third, we study how other countries might want to pursue anti-coercion policies to induce their domestic firms to switch to a home financial services sector that is less efficient but insulates the country from the hegemon's coercion. For example, following an earlier sanctions package applied to Russia in 2014, Russia developed a domestic messaging system called SPFS (System for Transfer of Financial Messages) that potentially helped Russia 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 U.S. coercion, but also as a mean to offer an alternative to other countries that might fear U.S. pressure.[20] 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 U.S. hegemon.

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."

[19]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 U.S. (e.g. a U.S. based SWIFT data center) or the threat of suspension of dealing with U.S. entities (see also Scott and Zachariadis (2014) and Cipriani et al. (2023)).

[20]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: **U.S. Financial Networks, Coercion, and Fragmentation**



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

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 U.S. 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 U.S. has one sector, the financial services sector denoted by j. Sector j produces out of a single factor ℓ_m, so that production is $f_j(\ell_j) = \ell_{jm}$. 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, $f_h(\ell_{hn}) = \ell_{hn}$. Given these linear production functions, we have $p_n^\ell = p_{h_n}$ and $p_m^\ell = p_j$.

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

$$f_i(x_{i_n j}, x_{i_n h_n}, z) = \left(A_j(z) x_{i_n j}^\sigma + A_{i_n h}(z) x_{i_n h}^\sigma \right)^{\beta/\sigma},$$

and we assume that this production function is identical in all countries n. 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 $0 < \beta < \sigma$, so that the hegemon's financial services and the home alternative are substitutes in production.

The crucial externalities that we study in this application are modeled simply as productivity parameters A's that depend on the overall usage of each financial service within and across countries. 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 increases the more countries around the world use those services, capturing a global strategic complementarity. The size of this externality is governed by the parameter ξ_j. Productivity $A_{i_n h}(z) = \overline{A}_h z_{i_n h}^{\xi_h \sigma}$ of the home alternative increases with the extent of usage of this input, a typical external economy of scale. The size of this externality is governed by the parameter ξ_h.[21] The chosen functional forms are standard ways to capture externalities in CES production functions (Bartelme et al. (2019), Ottonello et al. (2023)). 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.[22]

In each country, the manufacturing sector d_n produces using the local factor. We assume that, 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 $p_n^{\ell}\ell_{d_n n}$ (the cost of its factor input), it has to also purchase financial services $p_i x_{d_n i_n} = \gamma p_n^{\ell}\ell_{d_n n}$ for an exogenous $\gamma \in (0,1)$. Therefore the profit function of the manufacturing sector is:

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

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.[23] 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.[24]

[21]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 modeled 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 U.S. entities. Our framework can clearly handle indirect threats via foreign entities that themselves are connected to the U.S. (e.g. SWIFT).

[22]For technical reasons, we need to impose a small lower bound $\underline{x} > 0$ on use of input h, that is $x_{i_n h} \geq \underline{x}$. This constraint rules out a hegemon optimum with $x_{i_n h} = 0$, but does not bind.

[23]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.

[24]Given that the local factor is used both in manufacturing and in the financial services sector, we assume

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 $p_n^\ell \ell_{d_n n}$. 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 $(1+\gamma)p_n^\ell \ell_{d_n n}$. The net cost to the firm of the loan is the interest payment $\gamma p_n^\ell \ell_{d_n n}$ 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 $p_n^\ell \ell_{d_n n}$, the firm has to spend $(1+\gamma)p_n^\ell \ell_{d_n n}$, with payment $\gamma p_n^\ell \ell_{d_n n}$ 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. Livdan et al. (2024) build a network model in which the payment system is used by firms to access inputs and, using Russian data, find large negative economic effects of disruptions to the system.

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, $\frac{\partial u_n}{\partial z_{i_n j}} = \frac{\partial u_n}{\partial z_{i_n h}} = 0$, the effect of an increase in use of the hegemon's services j by an individual country's intermediary sector is the spillover to the productivity of every other country's intermediary sector. The 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*

$$\tau_{i_n j} = -\frac{\xi_j}{1+\xi_j} p_j, \qquad \tau_{i_n h} = -\frac{\xi_h}{1+\xi_h} p_h. \tag{17}$$

The global planner subsidizes use of both home and U.S. 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 $\overline{z}_j$, controlled by ξ_j. Intuitively, a larger strategic complementarity, a higher ξ_j, induces the planner to increase adoption by all intermediaries in order to generate productivity gains. The same logic underlies the

that its supply is sufficiently abundant that these sectors are never constrained in sourcing the factor.

subsidy $\tau_{i_n h}$ of the home alternative. Subsidies are bigger the stronger the economies of scale (the higher the ξ's).

Returning to Figure 3, the marginal cost curve in our application is given by

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

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 Outcome. We specialize Proposition 6 that characterizes the noncooperative outcome to this application. For simplicity, we take the large number of countries limit $N \to \infty$.

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

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

Country n's government places the same subsidy on the home alternative as did the global planner because the government internalizes the economy of scale in the use of the home alternative since the effects occur entirely within the domestic economy. On the other hand, country n's government does not internalize the global strategic complementarity in the adoption of the hegemon's financial services and places no tax or subsidy on their use, that is $\tau_{n,i_n j} = 0$. The noncooperative outcome, therefore, features efficient subsidies of the home alternative, but no subsidies of the hegemon's financial services. 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.[25] Starting from the wedge formula in Proposition 1, all terms except for the participation

[25] 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.

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

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

Importantly, $\Pi^o_{i_n}$ is a function of z_{i_nh}, 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.

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

$$\tau_{m,i_nj} = -\frac{\xi_j}{1+\xi_j} \left(p_j + \tau_{n,i_nj} \right), \qquad \tau_{m,i_nh} = \frac{\xi_h}{1+\xi_h} \left(\frac{x^o_{i_nh}}{x^*_{i_nh}} - 1 \right) \left(p_h + \tau_{n,i_nh} \right). \tag{18}$$

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 larger transfers. This aligns the hegemon's incentives with the global planner's in terms of choice of the wedge 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. 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 wedges on j.

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.

In contrast, compared with the global planner, the hegemon shifts towards discouraging the use of home financial services h. Because the hegemon maximizes the gap between the inside and outside option, the hegemon aims to reduce the productivity A_h of home financial services to lower the outside option of an intermediary that rejected the hegemon's contract. The hegemon imposes a smaller subsidy or even a tax on home financial service usage by intermediary i. There is no similar incentive to manipulate the outside option by changing A_j, precisely because the threatened punishment is to cut off access to services 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, 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.

Financial Hyper-Globalization. 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 8 *In the absence of anti-coercion policies ($\tau_n = 0$), the hegemon's optimum has higher use of its financial services $x_{i_n j}$ and 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. The hegemon is increasing the dependency of the rest of the world on its financial services to increase the power it can achieve by threatening withdrawals.

4.4 Financial Anti-Coercion Policy: Fragmentation Doom Loop

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 9 *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 $0 \leq \xi_h \leq \bar{\xi}_h$ (an 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's intermediaries use less of the hegemons' financial services. Due to the strategic complementarity, the hegemon's financial services j become less productive globally, and so also become 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 10 *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 ($\tau_{n,i_n j} \to \infty$) 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 it 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 10 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. We compare the welfare outcomes under the noncooperative outcome and the equilibrium with a hegemon and anti-coercion policies. The following result summarizes the welfare consequences as $N \to \infty$.

Proposition 11 *Let $N \to \infty$. The noncooperative outcome without a hegemon* Pareto *dominates the outcome with optimal anti-cercion and a hegemon.*

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 subsidizes its home alternative, $\tau_{n,i_n h} = -\frac{\xi_h}{1+\xi_h}$, but puts 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 higher use compared with the fragmentation outcome.

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 hegemonic 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.

Improving Welfare with Hegemon Commitment. Finally, we show how the hegemon can improve its own welfare through commitments to limit its ex-post coercion. By committing to these limits, the hegemon reduces other countries' incentives to adopt economic security policies. This parallels the general analysis of international organizations of Section 3.4 and Proposition 7. We provide a simple example of a commitment the hegemon could make to increase its welfare. We take the limit $N \to \infty$.

We consider two commitments: (i) a limit on transfers being a fraction $1-\mu$ of surplus, that is $T_i = (1-\mu)(V_i(\tau_m, \mathcal{J}_i) - V_i^o(\underline{\mathcal{J}}_i^o))$; and, (ii) to not impose wedges on foreign intermediaries, that is set

$\tau_m = 0$. These commitments could come in the form of establishing an international organization, like the IMF, that restricts the usage of financial coercion. In Appendix A.3.4, we show that if μ is sufficiently close to 1, then this commitment improves welfare for the hegemon by inducing foreign countries to allow at least some usage of the hegemon's financial services. Intuitively, the limited transfers that the hegemon demands induce the foreign countries to allow some usage of the hegemon's financial services to increase the inside option value of their intermediaries. Each country, however, relaxes its own security policies without taking into account the effect on other countries, which now also want to increase their dependency on the hegemon. The commitment kicks the fragmentation doom loop in reverse and the hegemon, therefore, is better off.

5 Quantifying Geoeconomic Power and Vulnerabilities

In this section, we use our model as a guide for examining the sources of geoeconomic power around the world and identifying key vulnerabilities for the target countries. We show that a parameterized version of our model with a nested-CES structure provides a simple sufficient statistics approach to measuring power and demonstrating the importance of finance in generating U.S. power. Our estimates also measure, at the sector level, the relative impact of anti-coercion policies that can be adopted by the target countries.

We consider a nested-CES production function in each country that uses domestic and foreign intermediate inputs to produce a final composite good.[26] We abuse notation by identifying a representative final-goods producer with its country of residence n (i.e., by denoting $i = n$). In keeping with the finance application of the previous subsection, we set the top CES layer to be an aggregator between financial services and a bundle of all other inputs (manufacturing, non-finance services, agriculture, etc...),

$$f_n\left(x_n\right) = A_n \left(\sum_{G \in \{M,F\}} \alpha_{nG}\; x_{nG}^{\frac{\varrho-1}{\varrho}}\right)^{\frac{\beta\varrho}{\varrho-1}},$$

where ϱ is the elasticity of substitution across sectors, β governs the returns to scale, and $\mathcal{G} = \{F, M\}$ is the set of sectors: F for finance, and M for all other goods and services. Each sector composite good x_{nG} is itself produced out of the output of sub-sectors $J \in \mathcal{J}_G$ with a CES aggregator of sub-sectors given by[27]

$$x_{nG} = \left(\sum_{J \in \mathcal{J}_G} \alpha_{nJ}\; x_{nJ}^{\frac{\rho_G-1}{\rho_G}}\right)^{\frac{\rho_G}{\rho_G-1}},$$

[26]Formally, there are a continuum of identical firms each with a nested-CES production function, so that we think of the collection as a representative final-good producer.

[27]We omit a productivity term A_{nG} because we can always fold that into the uppermost production function f_n by normalizing the weights α_{nG} and adjusting aggregate productivity A_n. Similar normalizations can be applied to productivity terms for the sub-sector composites.

where ρ_G is the elasticity of substitution across sub-sectors J in sector G. Each sub-sector composite good is itself an aggregator of home and foreign varieties in that sub-sector,

$$x_{nJ} = \left(\alpha_{nJn}\, x_{nJn}^{\frac{\varsigma_J - 1}{\varsigma_J}} + \alpha_{nJR}\, x_{nJR}^{\frac{\varsigma_J - 1}{\varsigma_J}}\right)^{\frac{\varsigma_J}{\varsigma_J - 1}}, \quad x_{nJR} = \left(\sum_{k \neq n} \alpha_{nJk}\, x_{nJk}^{\frac{\sigma_J - 1}{\sigma_J}}\right)^{\frac{\sigma_J}{\sigma_J - 1}},$$

where ς_J is the elasticity of substitution between home and foreign inputs in sub-sector J, and σ_J is the elasticity of substitution across different foreign countries' varieties of sub-sector J. Each country n has an intermediate goods producer that produces the country n variety of industry J linearly out of local factors of production. As a result, intermediate producer profits are constant at zero.[28]

We take the perspective that target economies are "small," in the small open economy sense, and therefore assume constant prices (Definition 1). This means that the hegemon's power over country n – that is, the loss to country n of losing access to the hegemon-controlled inputs – is equal to the loss of profits to the final goods producer. Importantly, our model allows the producer to fully reoptimize its input choices as it tries to find substitutes for the inputs it has lost access to. In this sense, our calculation is not about very short run effects that assume relationships in place are hard to substitute away from. We focus, instead, on the medium run horizon. We show that the power of hegemon m over country n can be computed from the following sufficient statistic.[29]

Proposition 12 *The hegemon's power over country n is given by*

$$\text{Power}_{mn} = \frac{\beta}{1-\beta}\frac{1}{1-\varrho}\log\left(\sum_{G\in\{M,F\}}\Omega_{nG}\left(\sum_{J\in\mathcal{J}_G}\Omega_{nGJ}\left(1-\Omega_{nJR}+\Omega_{nJR}\left(1-\omega_{nJR_m}\right)^{\frac{\varsigma_J-1}{\sigma_J-1}}\right)^{\frac{\rho_G-1}{\varsigma_J-1}}\right)^{\frac{\varrho-1}{\rho_G-1}}\right) \tag{19}$$

where Ω_{nG} is the expenditure share on sector G, Ω_{nGJ} is the share of sector G spending on sub-sector J, Ω_{nJR} is the share of sub-sector J spending on foreign inputs, and ω_{nJR_m} is the share of foreign input spending in sub-sector J controlled by the hegemon.

All else equal, this potential loss sets an upper bound on 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 power allows the model to make concrete empirical predictions and is simple to estimate. It provides both formal treatment and empirical content to the notion of geoeconomic power put forward by Hirschman (1945). We consider not only cases in which the hegemon only cuts

[28] In this production structure, all factor payments are made by the basic intermediate goods producers that only use the local factors. GDP is the sum of the final goods producers profits and the factor payments.

[29] It is a sufficient statistic in the sense that many parameters of the production function do not have to be estimated. For example, since the economy is small and even within the economy deviations are at the atomistic firm level, the z-externalities and factor specific productivities are all subsumed in the observed expenditure shares. This notion of power corresponds more closely to "micro-power" in Clayton et al. (2023).

off supply of its own inputs, in which case ω_{nJR_m} is the expenditure share on the hegemon's inputs, but also cases in which the hegemon coordinates a punishment coalition, in which case ω_{nJR_m} is the expenditure share on the inputs sold by all members of that coalition. Our measure of power is also related to the Arkolakis et al. (2012) calculations of the benefits of international trade, in which autarky is the counterfactual so that $\omega_{nJR_m} = 1$. In our framework power comes from the losses induced on producers, so that in this application $Power_{mn} = \log V_n(\mathcal{J}_n) - \log V_n^o(\mathcal{J}_n^o)$. The effect on country n's income w_n, which here coincides with GDP and consumer welfare, is obtained by scaling down $Power_{mn}$ by the fraction of aggregate income accounted for by profits.[30]

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 that country in equation (20). Consistent with our model, we present two versions: a narrow version in which the hegemon uses only the inputs in its own country to form threats, and a coalition version in which the hegemon also uses inputs in countries that are part of its political or economic network to make threats. As an example, in the narrow version the U.S. would use only its own correspondent banks to make threats of suspension of financial services, whereas in the coalition version the U.S. would also induce SWIFT, a Belgian cooperative entity, to join its threats. Practically, we study two coalitions. The American Coalition includes: U.S., all Euro Area countries, Canada, Australia, New Zealand, Japan, Sweden, Norway, Great Britain, Denmark, Switzerland, Taiwan, and South Korea. The Chinese Coalition includes China, Russia, Belarus, Syria, and Iran.[31] Our estimates do not take into account indirect effects, outside of the coalition, arising from value chains. For example, they do not take into account the Chinese content in goods that Vietnam exports to the U.S. (Baldwin et al. (2023)).

To gather intuition, we empirically implement our measure in the main text under the following simplifications: (i) a Cobb-Douglas aggregator at the sector level ($\varrho = 1$), (ii) we aggregate all non-finance sub-sectors together, that is $|\mathcal{J}_M| = 1$, meaning the elasticity ρ_G is no longer used. Under these conditions, equation 19 simplifies to

$$\text{Power}_{mn} = -\frac{\beta}{1-\beta} \sum_{G \in \{M,F\}} \Omega_{nG} \log \left[1 - \Omega_{nGR} + \Omega_{nGR} \left(1 - \omega_{nGR_m} \right)^{\frac{\varsigma_G - 1}{\sigma_G - 1}} \right]^{\frac{1}{\varsigma_G - 1}}. \tag{20}$$

Data Sources. To implement our measure, we use goods trade data from BACI, service trade data from the OECD-WTO Balanced Trade in Services (BaTIS), and domestic gross output data for all sectors from the OECD Inter Country Input Output (ICIO) tables. We aggregate both BACI and BaTIS to the same sectors used in the ICIO in order to ensure consistency in the measurement of domestic production. These bilateral trade and domestic gross output shares at the sector level

[30] In our model this fraction is $1 - \beta$ whenever the factor prices and endowments are assumed to be such that the factors are "just" used by the domestic producers. This is consistent with the final good of country n being consumed by its own consumer.

[31] The definition of China in this paper always includes Hong Kong and Macau.

are used to measure the expenditure shares in equations 19 and 20 (i.e. the Ωs and ωs). The trade elasticity of substitution is a notoriously difficult parameter to estimate (see Costinot and Rodríguez-Clare (2014) for a review). For the benchmark calibration of equation 20, we set the composite bundle elasticity to $\sigma_M = 6$ to deliver a trade elasticity of 5 as in Costinot and Rodríguez-Clare (2014) and the financial services bundle to $\sigma_F = 1.76$ following Rouzet et al. (2017).[32] We set $\varsigma_G = \frac{\sigma_G}{2}$ to account for the domestic variety being a relatively worse substitute for the bundle of foreign varieties than each foreign variety is with respect to other foreign varieties, as discussed in Feenstra et al. (2018).[33] This effectively reduces the aggregate trade elasticity, consistent with recent evidence in Boehm et al. (2023). Appendix A.3.7 provides the results under different assumptions on the elasticities and also calibrates the more disaggregated formula in equation 19 using the sectoral elasticities provided by Fontagné et al. (2022). We set the economies of scale parameter $\beta = 0.8$, which is within the range of estimates discussed in Basu and Fernald (1997) and Burnside et al. (1995).

Empirical Measure In Figure 5, we plot our measure of U.S. and China power over countries around the world for the year 2019.[34] As expected, the United States and China have more power over countries relatively close to them, with for example the U.S. displaying a large amount of power over Mexico and China over Vietnam. The difference between the sources of U.S. and China's power is stark. The overwhelming share of Chinese power arises from goods trade, with financial power only playing a significant role in Singapore, a financial center with close ties to China. The financial sector, instead, is an important source of power for the U.S. against most countries.

Our estimated losses are in the range of the trade literature estimated gains from trade, see for example Table 4.1 in Costinot and Rodríguez-Clare (2014) for a summary view across papers and methods.[35] Relatedly, Hausmann et al. (2024) measures the cost that the United States and Europe can impose on Russia via export controls in the Baqaee and Farhi (2022) framework.

Our estimated losses are also consistent with the special role of the basic financial sector in sustaining economic activity. Disruptions to this sector, even if it is a small part of gross expenditures, can cause large economic downturns (Kiyotaki and Moore (1997)).

The right panels of Figure 5 focus on the American and Chinese Coalitions and make these

[32] Rouzet et al. (2017) estimate an elasticity of substitution of 1.6 for financial services and 2.2 for insurance. Since we aggregate to the OECD sector of "finance" which combines both sub-sectors, 1.76 is the size-weighted average of the two sub-sectors in the BaTIS data.

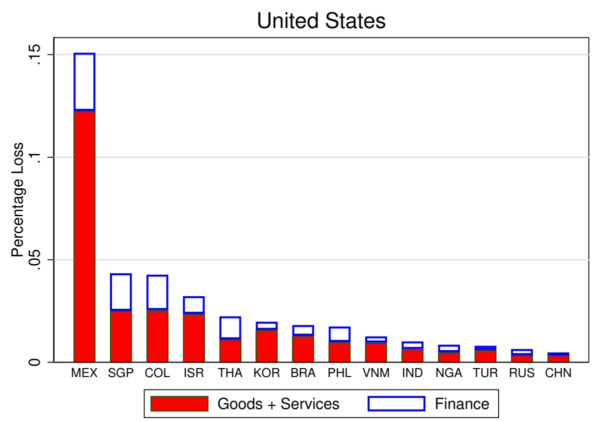
[33] It is crucial to account for the domestic alternatives in power calculations. All else equal, the hegemon has lower power over large countries that have vast domestic production capabilities and are therefore less reliant on foreign inputs.

[34] The year was chosen to be pre-Covid since many data sources are not available yet for the years post-Covid. Appendix A.3.7 presents the results for other years.

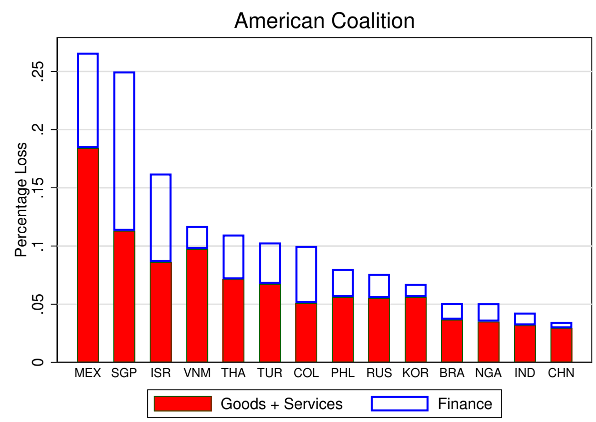
[35] Recall that our losses are expressed as percentage (log) changes in firms profits. The trade literature focuses on welfare gains to the total economy. Here the analogous metric is change in country income, which coincides with consumer welfare and GDP. Our numbers have to be scaled down by the profit share of total income, which corresponds to $1 - \beta$ (see footnote 30 above).

patterns even more stark. Obviously, the level of power increases particularly for the American Coalition given the economic size of the coalition and the amount of inputs it controls. More interestingly, the composition of the sources of power also changes with more of the overall power coming from finance in the American Coalition compared to the U.S. alone. The reason for this change is the nonlinearity in power that comes from controlling a sector almost entirely, as we discuss below.

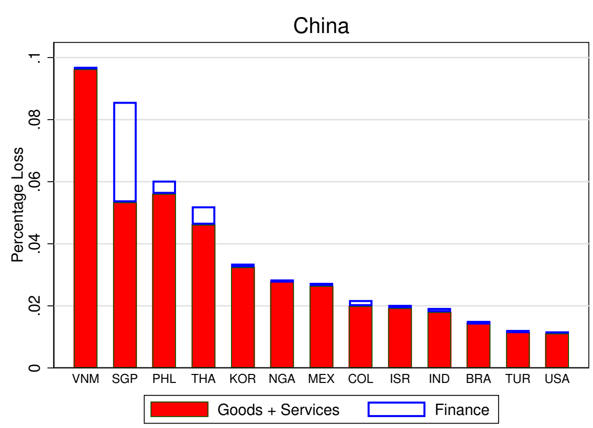
Figure 5: **USA and China Geoeconomic Power**



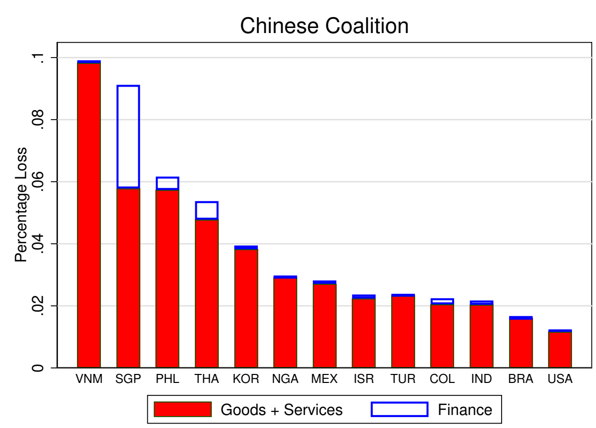
(a) United States



(b) American Coalition



(c) China



(d) Chinese Coalition

Notes: This figure plots estimates of the power as in equation (20). The vertical axis measures in percentage (log) points the economic loss to the country on the corresponding bar of the horizontal axis. The solid red bar is the loss arising from withholding all goods trade and non-finance services. The hollow blue bar is the loss arising from withholding financial services. The hegemon coalition making the threat is the (a) USA, (b) American Coalition, (c) China, (d) Chinese Coalition.

Dominance and the nonlinearity of Power. To understand the sources of geoeconomic power and its nonlinearity, we isolate the basic building block of equation 20: the basket of foreign varieties of intermediate inputs,

$$\left(\frac{1}{1-\omega_{nGR_m}}\right)^{\frac{1}{\sigma_J-1}}. \tag{21}$$

As is common in the trade literature, equation 21 represents the increase in the price index of this foreign basket of varieties that country n faces when the hegemon withholds the inputs it controls in that basket (see the proof of Proposition 12). For a given $\sigma_J > 1$, the price increase is infinite if the hegemon controls the entire basket, $\omega_{nGR_m} \uparrow 1$, since the new price index needs to induce the producer to use none of this basket. Power, therefore, is nonlinear in the share controlled by the hegemon, given by the function $\frac{1}{1-\omega_{nGR_m}}$. The difference between controlling 90% and 99% of the supply of an input is very large in terms of the power it can generate.

The importance of concentration in trade shares has a storied intellectual history. Hirschman (1945) states that "it will be an elementary defensive principle of the smaller trading countries not to have too large a share of their trade with any single great trading country [...]. The idea that dependence can be diminished by distributing the trade among many countries have been clearly enunciated by Macaulay."[36] He then designed an index, later known as the Herfindahl-Hirschman index, to measure how concentrated the bilateral trade shares are (chapter VI in Hirschman (1945)). We take advantage of 80 years of trade theory advances since then, to derive a formula for power that is not a simple Herfindahl-Hirschman index of trade shares, since it accounts for trade elasticities and domestic shares. Nevertheless, our measure builds on the earlier fundamental insight that concentration generates power.

Figure 6 shows that these nonlinearities are important in the data. The figure plots the distribution (kernel smoothed) of the shares ω_{nGR_m} controlled by China and the U.S. in finance and in goods and non-finance services.[37] Comparing Panels 6a and 6c for the U.S. and China respectively shows a stark pattern. The U.S. controls higher shares of financial services in most destination countries than it does in all other sectors. The opposite is true for China. Panel 6b shows that the American Coalition controls the vast majority of the finance basket in most destinations. This is a major source of power for the American Coalition and one of the reasons why in practice this coalition has resorted to financial sanctions so often. Once the coalition as a block cuts financial services to a destination country, there are few other alternatives available. China, at present, provides very little of the world's financial services compared to its overall economic size. The other major sources of financial services that we did not include in the American Coalition are Singapore and offshore financial centers such as Bermuda. If the U.S. could induce countries like Singapore to join its coalition, its power would increase considerably due to the nonlinearity that we have

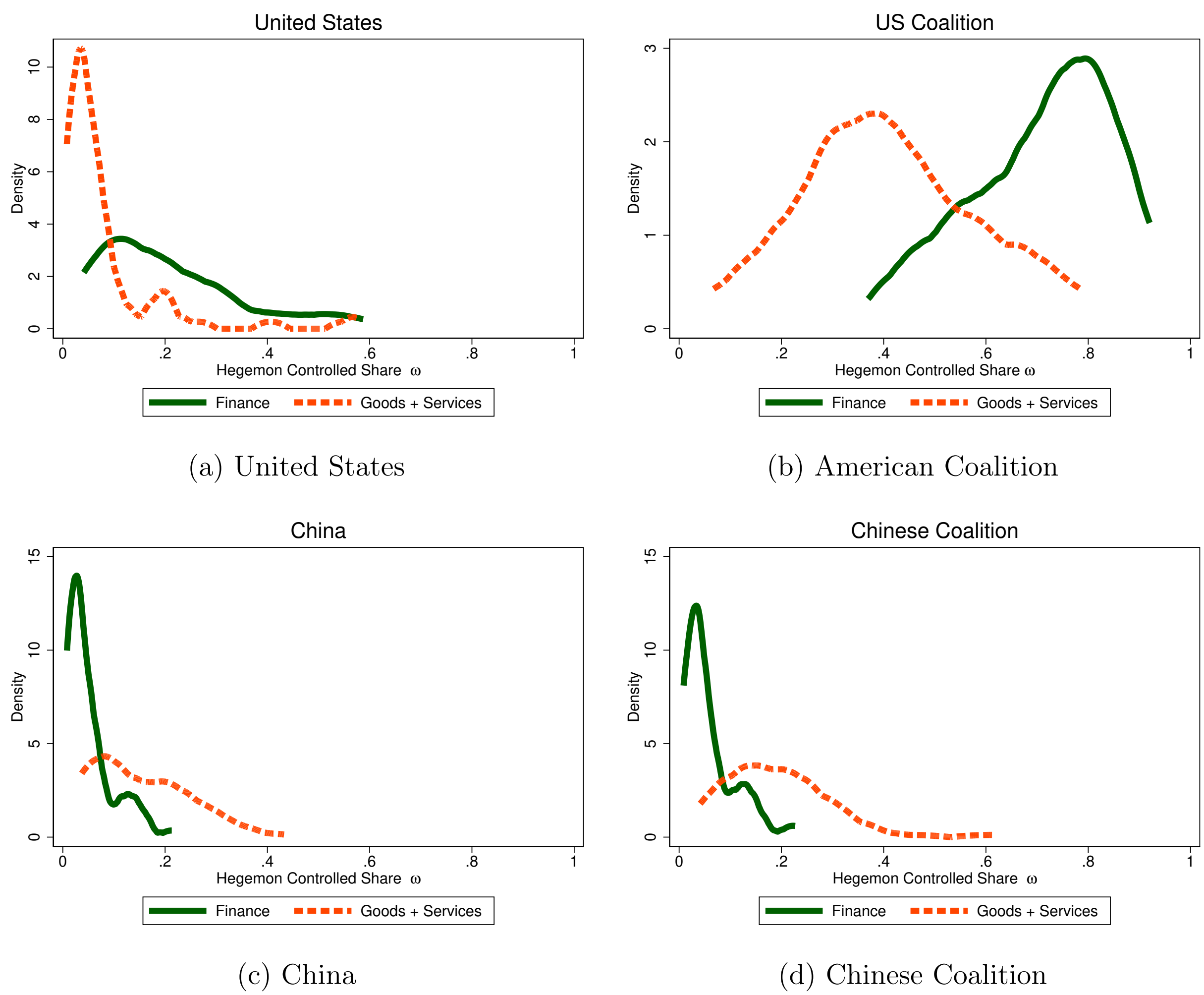
[36]The reference to Macaulay is based on Parliamentary Debates on the Corn Laws in Britain, in which Macaulay extolled the benefits of a more diverse source of trading partners.

[37]The level of aggregation of the sectors considered can of course affect the shares and mask more disaggregated inputs that China controls. For example, China might have high control shares in rare earths and other minerals important in the semiconductors value chain.

highlighted.

The other source of nonlinearity arises as the elasticity of substitution approaches one, i.e. getting close to Cobb Douglas. This effect is visible in equation 21 in which the exponent $\frac{1}{\sigma_J - 1}$ goes to infinity as $\sigma_J \downarrow 1$. If the foreign variety basket is Cobb Douglas, then controlling any one variety, an arbitrary small ω_{nGR_m}, is equivalent to controlling the entire basket since no production can take place without that single variety. To the extent that financial services have a low elasticity of substitution, then controlling them is a larger source of power. Indeed, estimates for the elasticity of substitution of financial services, however noisy, tend to be low, reflecting the fact that it is often difficult to find good alternatives (Pellegrino et al. (2021)).

Figure 6: **U.S. and China Dominance of Finance and Other Industries**



(a) United States (b) American Coalition

(c) China (d) Chinese Coalition

Notes: The figure plots kernel densities of the shares of imports controlled by the hegemon across destination countries in either finance or the composite of goods and non-finance services (ω_{nGR_m}). The dashed red line is the kernel density of the shares for goods trade and non-finance services. The solid green line is the kernel density for finance. The hegemon coalition making the threat is the (a) USA, (b) American Coalition, (c) China, (d) Chinese Coalition.

To better understand the nonlinearity of power, we define an iso-power curve by $Power_{mn} = \overline{u}$, as in equation 20. For a given scalar $\overline{u}$, the iso-power curve describes the pairs of hegemon controlled share of the financial services and hegemon controlled share of goods and services that generate $\overline{u}$ in power over country n for the hegemon. The slope of the iso-power curve is (for simplicity setting $\varsigma_G = 1$):

$$\frac{\partial \omega_{nMR_m}}{\partial \omega_{nFR_m}} = -\frac{\Omega_{nF}\Omega_{nFR}}{\Omega_{nM}\Omega_{nMR}} \frac{\sigma_M - 1}{\sigma_F - 1} \frac{1 - \omega_{nMR_m}}{1 - \omega_{nFR_m}}. \tag{22}$$

This slope highlights the nonlinearity: as the expenditure share on hegemon-controlled finance ω_{nFR_m} approaches 1, even very small additional increases in the hegemon's control of finance can increase power by as much as large increases in the hegemon's control over goods and other services.

Figure 7 traces out the resulting iso-power curves for our baseline calibration. Starting from the outer (blue dashed line) curve, the iso-power curve traces the combinations of shares of the two bundles that the hegemon has to control to achieve that level of power. At the extremes, the hegemon could control either 81% of the composite bundle and none of finance, or 93% of finance and none of the composite bundle. The intercepts are driven by the relative expenditure shares on the two bundles: all else equal, a lower hegemon controlled share of a bundle that is a higher expenditure share for the targeted country generates the same amount of power. Most countries have low expenditure shares on finance (low Ω_{nF}) so that, all else equal, financial services would not be a natural sector to generate geoeconomic power. But all else is *not* equal in practice: it is the high share controlled by the U.S. and by the American Coalition and the low elasticity of substitution that makes this sector important. This nonlinearity is visible in the graph since, as in equation 22, the iso-power curves highlight that power is convex: once the share of finance controlled by the hegemon gets above 85%, even small further increases in this share can compensate for large decreases of the share that the hegemon controls of all other sectors.

“Choke Points" and Economic Security Polices. Focusing on the targeted countries, the nonlinearity of power can be used to quantify those sectors in which the dependency on the hegemon inputs exposes the entire economy to the hegemon's coercion. These inputs are generally referred to as “choke points", pressure points, or critical dependencies.

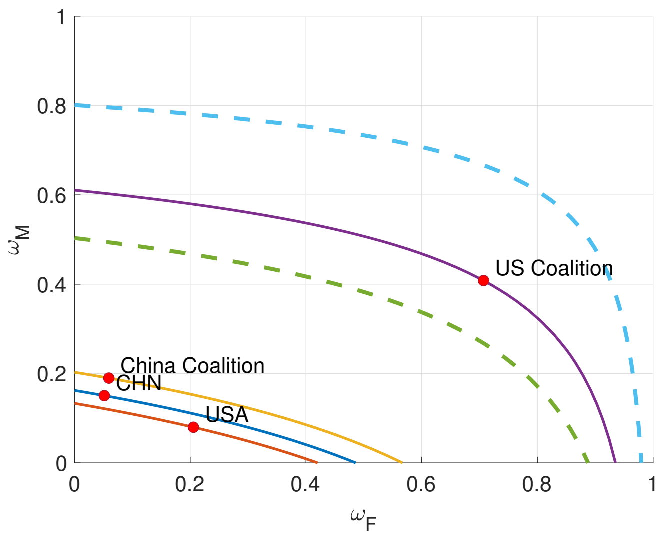
Suppose that an anti-coercion policy could shift a dollar towards the target country's expenditures on hegemon-controlled goods and away from hegemon-controlled finance, while holding fixed the country's total expenditures on each sector. The resulting decrease in the hegemon's power is a normalization of the slope of the iso-power curve:[38]

$$\frac{\sigma_M - 1}{\sigma_F - 1} \frac{1 - \omega_{nMR_m}}{1 - \omega_{nFR_m}} \tag{23}$$

When the hegemon controls a very high share of finance (ω_{nFR_m} is large), the hegemon's loss of power is disproportionately large from the shift of expenditure away from hegemon-controlled

[38]We keep considering the special case of $\varsigma_G = 1$ to build intuition. See Appendix A.2.17 for a full derivation. The normalization is due to the shares $\Omega_{nG}\Omega_{nGR}$ being over bundles that overall attract a different amount of spending by the target country.

Figure 7: **Iso-Power Curves**



Notes: Figure depicts iso-power curves. The points labeled CHN, USA, China Coalition and U.S. Coalition correspond to the unweighted cross-country mean share of foreign finance and composite goods and services controlled by China, the U.S. and their respective coalitions.

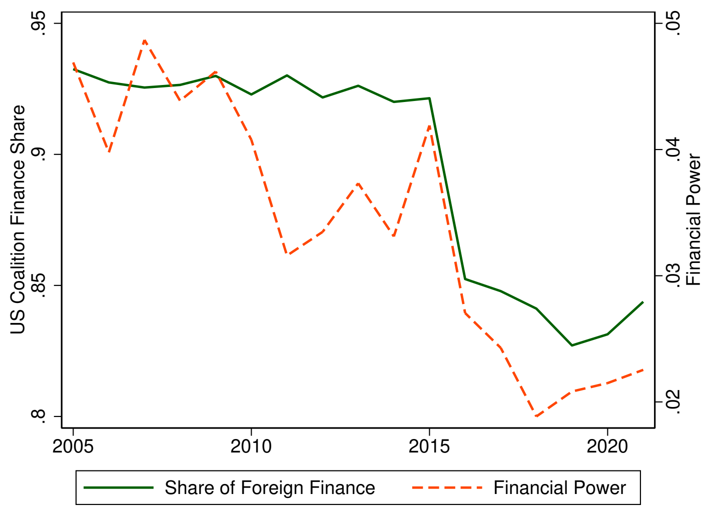
finance. This shift away from the hegemon's power does not necessarily come with a commensurate new dependency on other countries since, given the nonlinearity, power is not additive.

The nonlinearity in U.S. and American Coalition power arising from financial services brings up an important policy concern. A common view articulated in U.S. policy circles and media is that the dominance of the dollar makes U.S. power resilient to the presence of small alternatives. For example, China under many metrics only currently accounts for a small fraction of global financial services. The argument goes that even if China became a provider of 10 percent of world financial services, that would pale in comparison to the U.S. and American Coalition share. Although this argument is true in shares of expenditure, the nonlinearity of power means it is not true in terms of consequences for power. For the American Coalition, moving from controlling 90% of finance to controlling 80% of finance generates an enormous loss of power. However, this power does not accrue one-for-one to China since power is not additive. Intuitively, for a small to medium sized economy, the existence of an alternative provider with a 10 percent market share is enough to withstand much of the coercion exerted by the American Coalition without leaving it vulnerable to Chinese pressure.

The nonlinearity of power means that anti-coercion policy targeted at choke points can substantially increase a country's economic security even for a modest reallocation of its expenditures. Our estimates quantify those dependencies on which countries should act to diversify their sources of inputs. They also rationalize an often quoted principle of supply chains known as "China + 1" that pushes western managers to have at least one alternative to a Chinese supplier in the global value chain. The same, of course, applies in reverse to Chinese managers.

Indeed, China, Russia and the other BRICS countries are actively working on economic security policies that aim to create an alternative financial system architecture outside of the dollar-centric Western controlled system.[39] It is easy to dismiss plans for this architecture to meaningfully rival the western one in terms of usage shares and expenditure shares since these countries have rule of law and credibility issues. It is much less obvious that this alternative architecture could not sustain expenditure shares of 10 percent for many small and medium size countries around the world. Our analysis reveals that disproportionally more of the losses to U.S. power will come from this alternative going from 1 percent to 10, not from the next 40 percentage point increases.

Figure 8: **American Coalition Financial Power over Russia**



Notes: Figure plots the share of Russian imports of financial services controlled by the American Coalition ω_{iFRm} (solid green line) and the American Coalition financial power over Russia.

To illustrate this point in the data, we focus on the economic security policies Russia instituted after its invasion of Crimea in 2014. Russian leaders anticipated the possibility of future financial coercion by the American Coalition as they further invaded Ukraine in 2022. Anticipating the possibility of future sanctions, Russia actively reduced its financial dependence on the American Coalition.[40] Figure 8 shows that the share of Russian financial imports controlled by the American Coalition was a stable 94% before 2014 and subsequently dropped to 84% as Russia started to fragment from the global financial architecture.[41] As a consequence, the American Coalition's

[39]See the 2024 Kazan Declaration by BRICS countries and related Russian report.

[40]Appendix A.3.6 explores more generally the fragmentation resulting from recent geopolitical tensions and shows that our model implies a structural gravity equation linking country and hegemon preferences.

[41]Data on Russia's usage of foreign inputs, especially services, is notoriously noisy during a period of escalating Western sanctions. We used estimates of Russian imports of financial services provided by the WTO (BaTIS dataset with Balanced Values). According to these estimates Russia switched to China and Singapore as providers of financial services, with those countries shares moving from 0.55% and 1.0%, respectively, in 2013 to 6.2% and 2.3% in 2021. Interestingly, within the American Coalition there is a corresponding large increase in Cyprus which corresponds to the EU concerns of Russian control of Cypriot

financial power over Russia was approximately halved. This large loss in power is in part responsible for the muted effect of the financial sanctions that the American Coalition imposed after 2022 since Russia, via its ex-ante policies, had already prepared some alternatives.

6 Conclusion

Geoeconomic tensions have the potential to fragment the world trade and financial system, unwinding gains from international integration. Governments around the world are introducing mixes of industrial, trade, and financial policies to protect their economies from unwanted foreign influence. Collectively, these policies fall under the umbrella of Economic Security policy. We provide a model for jointly analyzing economic coercion by a hegemon and economic security policies by the rest of the world. We show that precisely those forces, like economies of scale, that are classic rationales for global integration and specialization can be used by a hegemon to increase its coercive power. Countries around the world react by implementing economic security policies that shift their domestic firms away from the hegemon's global inputs into an inefficient home alternative. We show these uncoordinated policies results in inefficient global fragmentation as each country over-insulates its economy. We focus on financial services as an industry with strong strategic complementarities at the global level. We derive simple statistics to measure geoeconomic power and estimate that the United States and its allies derive an outsized share of their power from their dominance of global finance. We show that power is nonlinear in the share of inputs controlled by the hegemon and demonstrate how only small reductions in American control of the international financial system come with significant reductions in American power.

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

Christopher Clayton Matteo Maggiori Jesse Schreger

December 2024

A.1 Economic Security and Anti-Coercion Policy

Several governments have recently put forward Economic Security Strategy initiatives aimed at de-risking 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 computing, 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 $\mathcal{J}_i^o \neq \underline{\mathcal{J}_i}^o$. 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 $i \in \mathcal{C}_m$. In particular, let $\tau_{m,ij}^* = \frac{\partial \Pi_i(x_i^*, \ell_i^*)}{\partial x_{ij}} - \tau_{n,ij}$ and $\tau_{if}^{\ell *} = \frac{\partial \Pi_i(x_i^*, \ell_i^*)}{\partial \ell_{if}} - \tau_{n,ij}^{\ell}$, then because firm i's optimization problem is convex, this implements the allocation (x_i^*, ℓ_i^*). Finally, every firm $i \notin \mathcal{C}_m$ 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 $i \notin \mathcal{C}_m$ 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 original 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 $i \in \mathcal{C}_m$, the hegemon's objective (equation 4) is also unchanged relative to the original contract. Thus the hegemon is indifferent between the implementable contracts $\{\mathcal{J}_i^o, T_i, \tau_i\}_{i \in \mathcal{C}_m}$ and $\{\underline{\mathcal{J}}_i^o, T_i, \tau_i^*\}_{i \in \mathcal{C}_m}$. Hence, it is

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

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 that 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

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

An increase in T_i holds fixed aggregate wealth, and therefore markets still clear. Thus we have found a feasible perturbation that is welfare improving for the hegemon, 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

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

subject to the non-negativity constraint on transfers,

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

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

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

where $r_{n,i}^*$ is revenue remissions from the country n government, which are taken as given by the hegemon. 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

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

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

Direct effect. First, we have the direct effect,

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

Thus substituting in the firm's FOCs, we have

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

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 $i \in \mathcal{I}_m$

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

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

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

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

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

We can then regroup terms as:

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

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* $ED = (ED_1, \ldots, ED_{|\mathcal{I}|}, ED_1^\ell, \ldots, ED_{|\mathcal{F}|})^T$*, 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 $\tau_{m,ij}$,

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

The network amplification for factors is identical to that 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

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

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

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

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 $i\in\mathcal{I}_n\setminus\mathcal{C}_m$, 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

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

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

$$\frac{\partial \mathcal{U}_n}{\partial z} = \frac{\partial W_n}{\partial w_n} \sum_{i\in\mathcal{I}_n} \left[\frac{\partial \Pi_i^o}{\partial z} + \tau_{n,i}\frac{\partial x_i^o}{\partial z} + \tau_{n,i}^\ell \frac{\partial \ell_i^o}{\partial z}\right] + \frac{\partial u_n}{\partial z}$$

Finally, for a price perturbation we have

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

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

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

Re-stacking,

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

Similarly, we have

$$\frac{\partial \mathcal{U}_n}{\partial z} = \frac{\partial W_n}{\partial w_n}\tau_n \frac{\partial \mathbf{x}_i^o}{\partial z} + \frac{\partial W_n}{\partial w_n} \sum_{i\in\mathcal{I}_n} \frac{\partial \Pi_i^o}{\partial z} + \frac{\partial u_n}{\partial z}$$

$$\frac{\partial \mathcal{U}_n}{\partial P} = \frac{\partial W_n}{\partial w_n}\tau_n \frac{\partial \mathbf{x}_i^o}{\partial P} + \frac{\partial W_n}{\partial P} + \frac{\partial W_n}{\partial w_n}\left[\sum_{i\in\mathcal{I}_n} \frac{\partial \Pi_i^o}{\partial P} + \sum_{f\in\mathcal{F}_n} \frac{\partial p_f^\ell}{\partial P}\bar{\ell}_f\right]$$

$$\frac{\partial \mathcal{U}_n}{\partial \tau_n} = \frac{\partial W_n}{\partial w_n}\tau_n \frac{\partial \mathbf{x}_i^o}{\partial \tau_n}$$

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

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

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

$$\begin{aligned}
0 =& \frac{\partial W_n}{\partial w_n}\tau_n \frac{\partial \mathbf{x}_i^o}{\partial \tau_n} \\
&+ \left[\frac{\partial W_n}{\partial w_n}\tau_n \frac{\partial \mathbf{x}_i^o}{\partial z} + \frac{\partial W_n}{\partial w_n}\sum_{i\in\mathcal{I}_n}\frac{\partial \Pi_i^o}{\partial z} + \frac{\partial u_n}{\partial z}\right]\frac{dz}{d\tau_n} \\
&+ \left[\frac{\partial W_n}{\partial w_n}\tau_n \frac{\partial \mathbf{x}_i^o}{\partial P} + \frac{\partial W_n}{\partial P} + \frac{\partial W_n}{\partial w_n}\left[\sum_{i\in\mathcal{I}_n}\frac{\partial \Pi_i^o}{\partial P} + \sum_{f\in\mathcal{F}_n}\frac{\partial p_f^\ell}{\partial P}\bar{\ell}_f\right]\right]\frac{dP}{d\tau_n}.
\end{aligned}$$

Rearranging, we obtain

$$\tau_n \frac{d\mathbf{x}_n^o}{d\tau_n} = -\left[\sum_{i\in\mathcal{I}_n}\frac{\partial \Pi_i^o}{\partial z} + \frac{1}{\frac{\partial W_n}{\partial w_n}}\frac{\partial u_n}{\partial z}\right]\frac{dz}{d\tau_n} - \left[\sum_{i\in\mathcal{I}_n}\frac{\partial \Pi_i^o}{\partial P} + \sum_{f\in\mathcal{F}_n}\frac{\partial p_f^\ell}{\partial P}\bar{\ell}_f + \frac{1}{\frac{\partial W_n}{\partial w_n}}\frac{\partial W_n}{\partial P}\right]\frac{dP}{d\tau_n}$$

where $\frac{d\mathbf{x}_n^o}{d\tau_n} = \frac{\partial \mathbf{x}_n^o}{\partial \tau_n} + \frac{\partial \mathbf{x}_n^o}{\partial z}\frac{dz}{d\tau_n} + \frac{\partial \mathbf{x}_n^o}{\partial P}\frac{dP}{d\tau_n}$.

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

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

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

$$\sum_{i\in\mathcal{I}_n}\frac{\partial \Pi_i^o}{\partial P} + \sum_{f\in\mathcal{F}_n}\frac{\partial p_f^\ell}{\partial P}\bar{\ell}_f + \frac{1}{\frac{\partial W_n}{\partial w_n}}\frac{\partial W_n}{\partial P} = \sum_{i\in\mathcal{I}_n}\frac{\partial p_i}{\partial P}\left[y_i^o - \overline{x}_i^o - C_{ni}\right] - \sum_{i\in\mathcal{I}\setminus\mathcal{I}_n}\frac{\partial p_i}{\partial P}\left[C_{ni} + \overline{x}_i^o\right] + \sum_{f\in\mathcal{F}_n}\frac{\partial p_f^\ell}{\partial P}\left[\bar{\ell}_f - \ell_f^o\right]$$

where we define $\overline{x}_i^o = \sum_{i'\in\mathcal{I}_n} x_{i'i}^o$ (and similarly $\overline{\ell}_f^o$). More generally, therefore, we can write

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

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

and so write

$$\sum_{i\in\mathcal{I}_n}\frac{\partial \Pi_i^o}{\partial P} + \sum_{f\in\mathcal{F}_n}\frac{\partial p_f^\ell}{\partial P}\bar{\ell}_f + \frac{1}{\frac{\partial W_n}{\partial w_n}}\frac{\partial W_n}{\partial P} = X_n^o$$

Thus substituting into the tax formula,

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

A.2.6 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 $\max_{\{\tau_{m,i}\}_{i\in\mathcal{I}_m}} \max_{\{\Gamma_i\}_{i\in C_m}} \mathcal{U}_m$ 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

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

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

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

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

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

Factor wedges are derived analogously,

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

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

A.2.7 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

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

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

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

$$0 = \Omega_n \frac{\partial W_n}{\partial w_{n_n}} \frac{\partial \Pi_i}{\partial x_{ij}} + \sum_{k=1}^{N} \Omega_k \left[\frac{\partial W_k}{\partial w_k} \sum_{i \in \mathcal{I}_k} \frac{\partial \Pi_i}{\partial z_{ij}} + \frac{\partial u_k}{\partial z_{ij}} \right]$$

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

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

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

A.2.8 Proof of Proposition 6

Absent a hegemon, the objective of country n is

$$\mathcal{U}_n = W_n\left(p, \sum_{i \in \mathcal{I}_n} V_i(\mathcal{J}_i) + \sum_{f \in \mathcal{F}_n} p^{\ell}_f \bar{\ell}_f \right) + u_n(z).$$

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

$$0 = \frac{\partial W_n}{\partial w_n} \frac{\partial \Pi_i}{\partial x_{ij}} + \left[\frac{\partial W_n}{\partial w_n} \sum_{i' \in \mathcal{I}_n} \frac{\partial \Pi_{i'}}{\partial z} + \frac{\partial u_n}{\partial z} \right] \frac{dz}{dx_{ij}} + \frac{\partial W_n}{\partial P} \frac{dP}{dx_{ij}}.$$

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

$$\tau_{n,ij} = -\left[\sum_{i' \in \mathcal{I}_n} \frac{\partial \Pi_{i'}}{\partial z} + \frac{1}{\frac{\partial W_n}{\partial w_n}} \frac{\partial u_n}{\partial z} \right] \frac{dz}{dx_{ij}} - \frac{1}{\frac{\partial W_n}{\partial w_n}} \frac{\partial W_n}{\partial P} \frac{dP}{dx_{ij}}.$$

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

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

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

$$\frac{\partial W_n}{\partial P} = \frac{\partial W_n}{\partial w_n}\sum_{i'\in\mathcal{I}} X_{n,i}\frac{\partial p_i}{\partial P}$$

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

$$\tau_{n,ij} = -\left[\sum_{i'\in\mathcal{I}_n}\frac{\partial \Pi_{i'}}{\partial z} + \frac{1}{\frac{\partial W_n}{\partial w_n}}\frac{\partial u_n}{\partial z}\right]\frac{dz}{dx_{ij}} - \sum_{i'\in\mathcal{I}} X_{n,i'}\frac{\partial p_{i'}}{\partial P}\frac{dP}{dx_{ij}}.$$

Factor wedges are derived analogously,

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

A.2.9 Proof of Proposition 7

From an ex-ante perspective, since wedges are revenue neutral we have $V_i(\tau_m, \mathcal{J}_i) = \Pi_i(\mathbf{x}_i^*)$ and $V_i^o(\underline{\mathcal{J}}_i^o) = \Pi_i(\mathbf{x}_i^o)$. Therefore, hegemon welfare is given by

$$\mathcal{U}_m = W(p, w_m) + u_m(z), \quad w_m = \sum_{i\in\mathcal{I}_m}\Pi_i + \sum_{f\in\mathcal{F}_m} p_f^{\ell}\bar{\ell}_f + \sum_{i\in\mathcal{C}_m}(1-\mu_i)\Big[\Pi_i(\mathbf{x}_i^*) - \Pi_i(\mathbf{x}_i^o)\Big].$$

Totally differentiating in μ_i, we have

$$\begin{aligned}\frac{\partial \mathcal{U}_m}{\partial \mu_i} \quad = \quad & -\tfrac{\partial W}{\partial w_m}\Big[\Pi_i(\mathbf{x}_i^*) - \Pi_i(\mathbf{x}_i^o)\Big] \\ & + \tfrac{\partial W}{\partial w_m}\Big[\textstyle\sum_{k\in\mathcal{I}_m}\tfrac{\partial \Pi_k}{\partial \mathbf{x}_k^*}\tfrac{d\mathbf{x}_k^*}{d\mu_i} + \sum_{k\in\mathcal{C}_m}(1-\mu_k)\Big[\tfrac{\partial \Pi_k}{\partial \mathbf{x}_k^*}\tfrac{d\mathbf{x}_k^*}{d\mu_i} - \tfrac{\partial \Pi_k^o}{\partial \mathbf{x}_k^o}\tfrac{d\mathbf{x}_k^o}{d\mu_i}\Big]\Big] \\ & + \tfrac{\partial W}{\partial w_m}\Big[\textstyle\sum_{k\in\mathcal{I}_m}\tfrac{\partial \Pi_k}{\partial z} + \sum_{k\in\mathcal{C}_m}(1-\mu_k)\Big[\tfrac{\partial \Pi_k}{\partial z} - \tfrac{\partial \Pi_i^o}{\partial z}\Big]\Big]\tfrac{dz}{d\mu_i} + \tfrac{\partial u_m}{\partial z}\tfrac{dz}{d\mu_i} \\ & + \tfrac{\partial W}{\partial P}\tfrac{dP}{d\mu_i} + \tfrac{\partial W}{\partial w_m}\Big[\textstyle\sum_{k\in\mathcal{I}_m}\tfrac{d\Pi_k}{dP} + \sum_{f\in\mathcal{F}_m}\tfrac{dp_f^{\ell}}{dP}\bar{\ell}_f + \sum_{k\in\mathcal{C}_m}(1-\mu_k)\Big[\tfrac{d\Pi_k}{dP} - \tfrac{d\Pi_k^o}{dP}\Big]\Big]\tfrac{dP}{d\mu_i}\end{aligned}$$

Using the firm FOCs $\frac{\partial \Pi_i}{\partial \mathbf{x}_i^*} = \tau_{m,i} \quad \forall i \in \mathcal{I}_m$, $\frac{\partial \Pi_i}{\partial \mathbf{x}_i^*} = \tau_{m,i} + \tau_{n,i} \quad \forall i \in \mathcal{C}_m$, and $\frac{\partial \Pi_i^o}{\partial \mathbf{x}_i^*} = \tau_{n,i} \quad \forall i \in \mathcal{C}_m$, and as usual using $\frac{\partial W}{\partial P} + \frac{\partial W}{\partial w_m}\sum_{i\in\mathcal{I}_m}\frac{d\Pi_i}{dP} + \sum_{f\in\mathcal{F}_m}\frac{dp_f^{\ell}}{dP}\bar{\ell}_f = \frac{\partial W}{\partial w_m}X_m$, we obtain the first order condition,

$$\Pi_i - \Pi_i^o \geq \sum_{k\in\mathcal{C}_m}(1-\mu_k)\left[\left(\frac{\partial \Pi_k}{\partial z} - \frac{\partial \Pi_k^o}{\partial z}\right)\frac{dz}{d\mu_i} + \left(\frac{d\Pi_k}{dP} - \frac{d\Pi_k^o}{dP}\right)\frac{dP}{d\mu_i} + (\tau_{m,k}+\tau_{n,k})\frac{d\mathbf{x}_k^*}{d\mu_i} - \tau_{n,k}\frac{d\mathbf{x}_k^o}{d\mu_i}\right]$$
$$+ X_m\frac{dP}{d\mu_i} + \left[\sum_{k\in\mathcal{I}_m}\frac{\partial \Pi_k}{\partial z} + \frac{\partial u_m}{\partial z}\right]\frac{dz}{d\mu_i} + \sum_{k\in\mathcal{I}_m}\tau_{m,k}\frac{d\mathbf{x}_k^*}{d\mu_i}$$

which is the result.

A.2.10 Proof of Corollary 1

Specializing Proposition 5 to the application, we have

$$\tau_{n,ij} = -\sum_{n=1}^{N}\frac{\partial \Pi_{i_n}}{\partial z_{ij}} = -\sum_{n=1}^{N} p_i \frac{\partial f_i}{\partial [A_j x_{i_n j}^\sigma]}\frac{\partial A_j}{\partial z_{ij}} x_{i_n j}^\sigma = -\xi_j \frac{1}{N}\sum_{n=1}^{N} p_i \frac{\partial f_i}{\partial [A_j x_{i_n j}^\sigma]}\sigma \overline{A}_j z_{ij}^{\xi_j \sigma - 1} x_{i_n j}^\sigma$$

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

$$p_j + \tau_{n,i_n j} = p_i \frac{\partial f_i}{\partial [A_j x_{i_n j}^\sigma]} A_j x_{i_n j}^{\sigma-1}\sigma$$

So that substituting in,

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

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

$$\tau_{n,ij} = -\frac{\xi_j}{1+\xi_j}p_j$$

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

A.2.11 Proof of Corollary 2

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

A.2.12 Proof of Corollary 3

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

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

The firm's FOC for j is

$$p_i \frac{\partial f_i}{\partial [A_j x_{i_n j}^\sigma]}\sigma A_j x_{i_n j}^{\sigma-1} = p_j + \tau_{m,i_n j} + \tau_{n,ij}$$

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

$$\tau_{m,ij} = -\xi_j(p_j + \tau_{m,ij} + \tau_{n,ij}),$$

which yields the result,

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

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

$$\tau_{m,ih} = -\left(\frac{\partial \Pi_i}{\partial z_{ih}} - \frac{\partial \Pi_i^o}{\partial z_{ih}}\right).$$

By Envelope Theorem,

$$\frac{\partial \Pi_i^o}{\partial z_{ih}} = p_i \frac{\partial f_i^o}{\partial [A_{i_nh} x_{i_nh}^{o\sigma}]} \overline{A}_j \xi \sigma z_{i_nh}^{\xi\sigma-1} x_{i_nh}^{o\sigma},$$

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

$$p_i \frac{\partial f_i^o}{\partial [A_{i_nh} x_{i_nh}^{o\sigma}]} A_j x_{i_nh}^{o\sigma-1} \sigma = p_j + \tau_{n,i_nh}$$

we therefore have

$$\frac{\partial \Pi_{i_n}^o}{\partial z_{i_nh}} = \xi_h (p_j + \tau_{n,i_nh}) \frac{x_{i_nh}^o}{z_{i_nh}}$$

Thus substituting in,

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

Finally, rearranging gives

$$\tau_{m,ih} = \frac{\xi_h}{1+\xi_h} \left(\frac{x_{ih}^o}{x_{ih}^*} - 1 \right) \left(p_j + \tau_{n,ih} \right)$$

which completes the proof.

A.2.13 Proof of Proposition 8

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

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

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

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

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 $\Pi_i^o(z_{ih})$ in the objective. We thus proceed by writing the objective

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

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 $\frac{\Pi_i^o}{\partial z_{ih}} > 0$ and $\frac{\partial \Pi_i^o}{\partial z_{ij}} = 0$, 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.2.14 Proof of Proposition 9

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

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

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 denote 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_i^o 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

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

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

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

Finally, we have

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

so that

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

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 in $(x_{ij}, -x_{ih}, X_{ij}, -X_{ih})$.

Monotone Comparative Statics. Given supermodularity, we next invoke monotone comparative statics. First we take τ_{n,i_nj}. Since the outside option does not depend on τ_{n,i_nj} and since countries $-n$ objectives do not depend on τ_{n,i_nj}, we have

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

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

Next, we take τ_{n,i_nh}. By Envelope Theorem, we have

$$\frac{\partial \mathcal{U}_m}{\partial \tau_{n,i_nj}} = -x_{i_nh} + x_{i_nh}^{o}$$

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

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

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

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

so that we have

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

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

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

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

$$\frac{\partial^2 \mathcal{U}_m}{\partial \tau_{n,i_n j} \partial(-x_{i_n h})} > 1 - c\frac{1}{c} = 0$$

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

A.2.15 Proof of Proposition 10

Consider the objective of the country n government, which solves

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

where we have

$$\Pi^o_i = \max_{x^o_{i_n h}} p_i \overline{A}_h^{\beta/\sigma} z_{i_n h}^{\xi_h \beta} x_{i_n h}^{o\beta} - p_h x^o_{i_n h} - \tau_{i_n h}(x^o_{i_n h} - x^{o*}_{i_n h}),$$

where the optimal policy is

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

Substituting in the optimal policy, we have

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

Therefore, we have

$$\frac{\partial \Pi^o_i}{\partial z_{i_n h}} > 0$$

$$\frac{\partial \Pi^o_i}{\partial z_{i_n j}} = 0$$

$$\frac{\partial \Pi_i^o}{\partial z_{i_r j}}, \frac{\partial \Pi_i^o}{\partial z_{i_r h}} = 0 \quad \forall r \neq n$$

that is, the welfare of country n is increasing in home use $z_{i_n h}$ and constant in all other other elements of z. From Proposition 9, we therefore have

$$\frac{\partial \Pi_i^o}{\partial \tau_{n,i_n j}} = \frac{\partial \Pi_i^o}{\partial z_{i_n h}} \frac{\partial z_{i_n h}}{\partial \tau_{n,i_n j}} \geq 0$$

and therefore, welfare is maximized by $\tau_{n,i_n j} \to \infty$.

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

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

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

A.2.16 Proof of Proposition 11

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

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

which follows from the Inada condition.

A.2.17 Proof of Proposition 12

Consider first the outermost layer of nesting over sectors, and denote P_{nG} to be the price index of the sector G composite (which remains to be derived). The standard CES price index for final production is given by $P_n = \left(\sum_{G \in \mathcal{G}} \alpha_{ng}^{\varrho} P_{nG}^{1-\varrho} \right)^{\frac{1}{1-\varrho}}$. Given this final price index, the final goods producer solves

$$\max_{X_n} A_n X_n^{\beta} - P_n X_n,$$

which yields optimal production $X_n = \left(\beta \frac{A_n}{P_n} \right)^{\frac{1}{1-\beta}}$ and a value function as a function of the price index given by

$$v_n(P_n) = \left[A_n \left(\beta A_n \right)^{\frac{\beta}{1-\beta}} - \left(\beta A_n \right)^{\frac{1}{1-\beta}} \right] P_n^{-\frac{\beta}{1-\beta}} . v_n(P_n) = \left[A_n \left(\beta A_n \right)^{\frac{\beta}{1-\beta}} - \left(\beta A_n \right)^{\frac{1}{1-\beta}} \right] P_n^{-\frac{\beta}{1-\beta}} .$$

The log loss from losing access to a subset of goods, $V_n(\mathcal{J}_n) - V_n(\mathcal{J}_n^o)$, is therefore given by the corresponding change in the price index,

$$\log V_n(\mathcal{J}_n) - \log V_n(\mathcal{J}_n^o) = -\frac{\beta}{1-\beta} \log \frac{P_n}{P_n^o}.$$

Substituting in the definition of the price index, we have

$$\begin{aligned}
\log V_n(\mathcal{J}_n) - \log V_n(\mathcal{J}_n^o) &= \frac{\beta}{1-\beta} \frac{1}{1-\varrho} \log \frac{\sum_{G\in\mathcal{G}} \alpha_{nG}^{\varrho} (P_{nG}^o)^{1-\varrho}}{\sum_{G\in\mathcal{G}} \alpha_{nG}^{\varrho} (P_{nG})^{1-\varrho}} \\
&= \frac{\beta}{1-\beta} \frac{1}{1-\varrho} \log \sum_{G\in\mathcal{G}} \frac{\alpha_{nG}^{\varrho} P_{nG}^{1-\varrho}}{\sum_{G\in\mathcal{G}} \alpha_{nG}^{\varrho} (P_{nG})^{1-\varrho}} \frac{(P_{nG}^o)^{1-\varrho}}{(P_{nG})^{1-\varrho}} \\
&= \frac{\beta}{1-\beta} \frac{1}{1-\varrho} \log \left\{ \sum_{G\in\mathcal{G}} \Omega_{nG} \left[\frac{P_{nG}^o}{P_{nG}} \right]^{1-\varrho} \right\}
\end{aligned}$$

where $\Omega_{nG} = \frac{\alpha_{nG}^{\varrho} P_{nG}^{1-\varrho}}{\sum_{G\in\mathcal{G}} \alpha_{nG}^{\varrho} (P_{nG})^{1-\varrho}}$ is the expenditure share on G and where P_{nG}^o is the price index after losing access to hegemon-controlled inputs. Next, the price index for G is given by $P_{nG} = \left(\sum_{J\in\mathcal{J}_G} \alpha_{nJ}^{\rho_G} P_{nJ}^{1-\rho_G} \right)^{\frac{1}{1-\rho_G}}$, which by the same calculations as above yields

$$\frac{P_{nG}^o}{P_{nG}} = \left(\sum_{J\in\mathcal{J}_G} \frac{\alpha_{nJ}^{\rho_G} P_{nJ}^{1-\rho_G}}{\sum_{J\in\mathcal{J}_G} \alpha_{nJ}^{\rho_G} P_{nJ}^{1-\rho_G}} \left(\frac{P_{nJ}^o}{P_{nJ}} \right)^{1-\rho_G} \right)^{\frac{1}{1-\rho_G}} = \left(\sum_{J\in\mathcal{J}_G} \Omega_{nGJ} \left(\frac{P_{nJ}^o}{P_{nJ}} \right)^{1-\rho_G} \right)^{\frac{1}{1-\rho_G}}.$$

Substituting back in yields

$$\log V_n(\mathcal{J}_n) - \log V_n(\mathcal{J}_n^o) = \frac{\beta}{1-\beta} \frac{1}{1-\varrho} \log \left\{ \sum_{G\in\mathcal{G}} \Omega_{nG} \left[\sum_{J\in\mathcal{J}_G} \Omega_{nGJ} \left(\frac{P_{nJ}^o}{P_{nJ}} \right)^{1-\rho_G} \right]^{\frac{1-\varrho}{1-\rho_G}} \right\}.$$

Going the next layer down (to home and foreign), we have by the same calculations and using that home goods are never cut off,

$$\frac{P_{nJ}^o}{P_{nJ}} = \left[1 - \Omega_{nGJR} + \Omega_{nGJR} \left(\frac{P_{nJR}^o}{P_{nJR}} \right)^{1-\varsigma_J} \right]^{\frac{1}{1-\varsigma_J}}.$$

Finally, going the last step down, we have $\frac{P_{nJR}^o}{P_{nJR}} = \left(1 - \omega_{nJR_m} \right)^{\frac{1}{1-\sigma_J}}$. Thus substituting back in, we obtain

$$\log V_n(\mathcal{J}_n) - \log V_n(\mathcal{J}_n^o) = \frac{\beta}{1-\beta} \frac{1}{1-\varrho} \log \left\{ \sum_{G\in\mathcal{G}} \Omega_{nG} \left[\sum_{J\in\mathcal{J}_G} \Omega_{nGJ} \left[1 - \Omega_{nGJR} + \Omega_{nGJR} \left(1 - \omega_{nJR_m} \right)^{\frac{1-\varsigma_J}{1-\sigma_J}} \right]^{\frac{1-\rho_G}{1-\varsigma_J}} \right]^{\frac{1-\varrho}{1-\rho_G}} \right\}$$

which is equation 19.

Specializing the formula with $\varrho = 1$ and $|\mathcal{J}_G| = 1$, we have

$$\log V_n(\mathcal{J}_n) - \log V_n(\mathcal{J}_n^o) = \frac{\beta}{1-\beta} \lim_{\varrho \to 1} \frac{1}{1-\varrho} \log \left\{ \sum_{G \in \mathcal{G}} \Omega_{nG} \left[1 - \Omega_{nGR} + \Omega_{nGR} \Big(1 - \omega_{nGR_m} \Big)^{\frac{1-\varsigma_G}{1-\sigma_G}} \right]^{\frac{1-\varrho}{1-\varsigma_G}} \right\}$$

$$= -\frac{\beta}{1-\beta} \sum_{G \in \mathcal{G}} \Omega_{nG} \log \left[1 - \Omega_{nGR} + \Omega_{nGR} \Big(1 - \omega_{nGR_m} \Big)^{\frac{\varsigma_G - 1}{\sigma_G - 1}} \right]^{\frac{1}{\varsigma_G - 1}}$$

which is equation 20.

Iso-Power Curve. The iso-power curve is defined by $Power_{mn} = \overline{u}$, that is

$$-\frac{\beta}{1-\beta} \sum_{G \in \mathcal{G}} \Omega_{nG} \log \left[1 - \Omega_{nGR} + \Omega_{nGR} \Big(1 - \omega_{nGR_m} \Big)^{\frac{\varsigma_G - 1}{\sigma_G - 1}} \right]^{\frac{1}{\varsigma_G - 1}} = \overline{u}.$$

Taking the special case $\varsigma_J = 1$, we have

$$\text{Power}_{mn} = -\frac{\beta}{1-\beta} \sum_{G \in \{F,M\}} \Omega_{nG} \Omega_{nGR} \frac{1}{\sigma_G - 1} \log(1 - \omega_{nGR_m}).$$

Therefore, the slope of the iso-power curve in this case is given by

$$\frac{\partial \omega_{nMR_m}}{\partial \omega_{nFR_m}} = -\frac{\Omega_{nF}\Omega_{nFR}}{\Omega_{nM}\Omega_{nMR}} \frac{\sigma_M - 1}{\sigma_F - 1} \frac{1 - \omega_{nMR_m}}{1 - \omega_{nFR_m}}$$

Marginal Increase in Power. Again taking the special case of $\varsigma_J = 1$, we let $\omega_{nGR_m} = \frac{E_{nGR_m}}{E_{nGR}}$, where E_{nGR_m} is expenditures on hegemon-controlled inputs G and E_{nGR} is expenditures on all foreign inputs G. Then, we have

$$\frac{\partial \text{Power}_{mn}}{\partial E_{nGR_m}} = \frac{\beta}{1-\beta} \Omega_{nG} \Omega_{nGR} \frac{1}{\sigma_G - 1} \frac{1}{1 - \frac{E_{nGR_m}}{E_{nGR}}} \frac{1}{E_{nGR}} = \frac{\beta}{1-\beta} \frac{1}{\sigma_G - 1} \frac{1}{1 - \omega_{nGR_m}} \frac{1}{E_n}$$

where the last equality follows from $\Omega_{nG}\Omega_{nGR}E_n = E_{nGR}$. Therefore, we have

$$\frac{\partial \text{Power}_{mn} / \partial E_{nFR_m}}{\partial \text{Power}_{mn} / \partial E_{nMR_m}} = \frac{\sigma_M - 1}{\sigma_F - 1} \frac{1 - \omega_{nMR_m}}{1 - \omega_{nFR_m}}$$

which reflects the efficiency of finance relative to goods and services in generating power, and is a rescaling of the slope of the iso-power curve.

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 (i.e., country n's utility can depend on other countries' diplomatic actions). 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 associated with the government rejecting the contract, from punishments associated with 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. For example, if firm $i \in \mathcal{I}_n$ accepts the contract but government n rejects the contract, the firm i avoids punishment $\mathcal{J}_i^o$ but incurs punishment $\mathcal{J}_i^g$ 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

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

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

$$\mathcal{U}_n^* + \psi_n(a^*) \geq \mathcal{U}_n^o(\mathcal{P}_n^g) + \sup_{a_n} \psi_n(a_n, a_{-n}^*). \tag{A.3}$$

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

$$\mathcal{P}_n^{g*} = \arg\inf_{P_n^g} \mathcal{U}_n^o(\mathcal{P}_n^g). \tag{A.4}$$

Lemma 2, which proved the optimality of binding firm participation constraints, is not immediate

[4]It is straightforward 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.

in this setting. This is because transfers can affect the government participation constraint (equation A.3) 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 13 *Under an optimal contract:*

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

$$\begin{aligned}\tau_{m,ij} = &-\frac{1}{1+\eta_i}\Bigg[\overbrace{\sum_{k\neq m}\phi_k\left(\frac{d\mathcal{U}_k^*}{dx_{ij}} - \frac{d\mathcal{U}_k^o}{dx_{ij}}\right)}^{\text{Building Power (Governments)}} + \overbrace{\sum_{k\in\mathcal{C}_m}\left(1+\eta_k\right)\left[\left(\frac{\partial\Pi_k}{\partial z} - \frac{\partial\Pi_k^o}{\partial z}\right)\frac{dz}{dx_{ij}} + \left(\frac{\partial\Pi_k}{\partial P} - \frac{\partial\Pi_k^o}{\partial P}\right)\frac{dP}{dx_{ij}}\right]}^{\text{Building Power (Firms)}}\Bigg] \\ &-\frac{1}{1+\eta_i}\Bigg[\underbrace{X_m\frac{dP}{dx_{ij}}}_{\text{Terms-of-Trade}} + \underbrace{\left[\sum_{k\in\mathcal{I}_m}\frac{\partial\Pi_k}{\partial z} + \frac{\partial u_m}{\partial z}\right]\frac{dz}{dx_{ij}}}_{\text{Domestic } z\text{-Externalities}} + \underbrace{\sum_{k\in\mathcal{I}_m}\tau_{m,k}\frac{d\boldsymbol{x}_k}{dx_{ij}}}_{\text{Private Distortion}}\Bigg]\end{aligned} \tag{A.5}$$

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

$$0 = \frac{\partial\psi_m(a^*)}{\partial a_n^*} + \phi_n\frac{\partial\psi_n(a^*)}{\partial a_n^*} + \sum_{k\notin\{n,m\}}\phi_k\left(\frac{\partial\psi_k(a^*)}{\partial a_n^*} - \frac{\partial\psi_k(a_k^o, a_{-k}^*)}{\partial a_n^*}\right) \tag{A.6}$$

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

The first part of Proposition 13 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 extent 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 13 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 it becomes easier to ask each country to coordinate onto it.

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 14 *The optimal domestic policy of country n satisfies*

$$\tau_n \frac{d\boldsymbol{x}_n^o}{d\tau_n} = -\left[\sum_{i\in\mathcal{I}_n} \frac{\partial \Pi_i^o}{\partial z} + \frac{\partial u_n}{\partial z}\right] \frac{dz}{d\tau_n} - X_n^o \frac{dP}{d\tau_n} - \frac{\partial \psi_n(a^*)}{\partial a^*} \frac{da^*}{d\tau_n} \tag{A.7}$$

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 shape 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.7.

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 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.3.1.1 Proof of Proposition 13

Parallel to the proof of Proposition 1, the hegemon's Lagrangian is

$$\begin{aligned}\mathcal{L}_m =& W_m\Big(p, \sum_{i\in\mathcal{I}_m} V_i(\mathcal{J}_i) + \sum_{f\in\mathcal{F}_m} p_f^\ell \bar{\ell}_f + \sum_{i\in C_m}\Big(\Pi_i(x_i,\ell_i,\mathcal{J}_i) - \tau_{n,i}x_i - \tau_{n,i}^\ell \ell_i + r_{n,i}^* - V_i^o(\underline{\mathcal{J}}_i)\Big)\Big) + u_m(z)\\ &+ \sum_{i\in\mathcal{C}_m}\eta_i\Big[\Pi_i(x_i,\ell_i,\mathcal{J}_i) - \tau_{n,i}x_i - \tau_{n,i}^\ell \ell_i + r_{n,i}^* - V_i^o(\underline{\mathcal{J}}_i)\Big]\\ &+ \sum_{n\neq m}\phi_n\Big[\mathcal{U}_n^* + \psi_n(a^*) - \mathcal{U}_n^o - \sup_{a_n}\psi_n(a_n, a_{-n}^*)\Big]\end{aligned}$$

First for the optimal wedge, all derivations are analogous to the proof of Proposition 1 up to the new constraint. We therefore have

$$\begin{aligned}\tau_{m,ij} =& -\frac{1}{1+\eta_i}\Bigg[\sum_{k\neq m}\phi_k\left(\frac{d\mathcal{U}_k^*}{dx_{ij}} - \frac{d\mathcal{U}_k^o}{dx_{ij}}\right) + \sum_{k\in\mathcal{C}_m}\Big(1+\eta_k\Big)\Bigg[\left(\frac{\partial\Pi_k}{\partial z} - \frac{\partial\Pi_k^o}{\partial z}\right)\frac{dz}{dx_{ij}} + \left(\frac{\partial\Pi_k}{\partial P} - \frac{\partial\Pi_k^o}{\partial P}\right)\frac{dP}{dx_{ij}}\Bigg]\Bigg]\\ &-\frac{1}{1+\eta_i}\Bigg[X_m\frac{dP}{dx_{ij}} + \Bigg[\sum_{k\in\mathcal{I}_m}\frac{\partial\Pi_k}{\partial z} + \frac{\partial u_m}{\partial z}\Bigg]\frac{dz}{dx_{ij}} + \sum_{k\in\mathcal{I}_m}\tau_{m,k}\frac{d\mathbf{x}_k}{dx_{ij}}\Bigg]\end{aligned}$$

where $\frac{d\mathcal{U}_k^*}{dx_{ij}}$ and $\frac{d\mathcal{U}_k^o}{dx_{ij}}$ are the corresponding total derivatives. Note that this includes derivatives in the hegemon's wedges.

Finally, taking the first order condition for the optimal action,

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

A.3.1.2 Proof of Proposition 14

Following the proof of Proposition 3, we can write the objective of country n as

$$W_n\Big(p, \sum_{i\in\mathcal{I}_n\cap\mathcal{C}_m} V_i^o(\underline{\mathcal{J}}_i) + \sum_{i\in\mathcal{I}_n\setminus\mathcal{C}_m} V_i(\mathcal{J}_i) + \sum_{f\in\mathcal{F}_m} p_f^\ell\bar{\ell}_f\Big) + u_n(z) + \psi_n(a_n^*).$$

This objective is the same except for the separable term ψ_n. Therefore using the same steps as in the proof of Proposition 3, we have

$$\tau_n\frac{d\mathbf{x}_n^o}{d\tau_n} = -\Bigg[\sum_{i\in\mathcal{I}_n}\frac{\partial\Pi_i^o}{\partial z} + \frac{\partial u_n}{\partial z}\Bigg]\frac{dz}{d\tau_n} - X_n^o\frac{dP}{d\tau_n} - \frac{\partial\psi_n(a^*)}{\partial a^*}\frac{da^*}{d\tau_n}$$

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

$$V_i(\Gamma_i) \geq \mu V_i^o(\mathcal{J}_i^o) + (1-\mu)V_i(\mathcal{J}_i). \tag{A.8}$$

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.8 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 from 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 an "incentive compatibility of punishments" (IC) 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 introducing 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 Value of Commitment in Section 4.4 Application

We take 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 10, 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 10) 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.3.6 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 15 *Purchases x_{iJn} by firm i of the industry-J goods produced in country n satisfy*

$$\log x_{iJn} = \gamma_{iJ} + \gamma_{Jn} + \sigma_J \log \alpha_{iJn} - \sigma_J \log(1 + \bar{t}_{iJn}) \tag{A.9}$$

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.

A.3.6.1 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 15 to this example and letting $\log(1 + \bar{t}_{iJn}) \approx \bar{t}_{iJn}$, we have

$$\log x_{iJn'} \approx \gamma_{iJ} + \gamma_{Jn'} + \sigma_J \log \alpha_{iJn'} + \theta \sigma_J \epsilon_J \zeta_{nn'}. \tag{A.10}$$

Consider therefore predicting trade patterns $\log x_{iJn'}$ using alignment $\zeta_{nn'}$. Equation (A.10) 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.

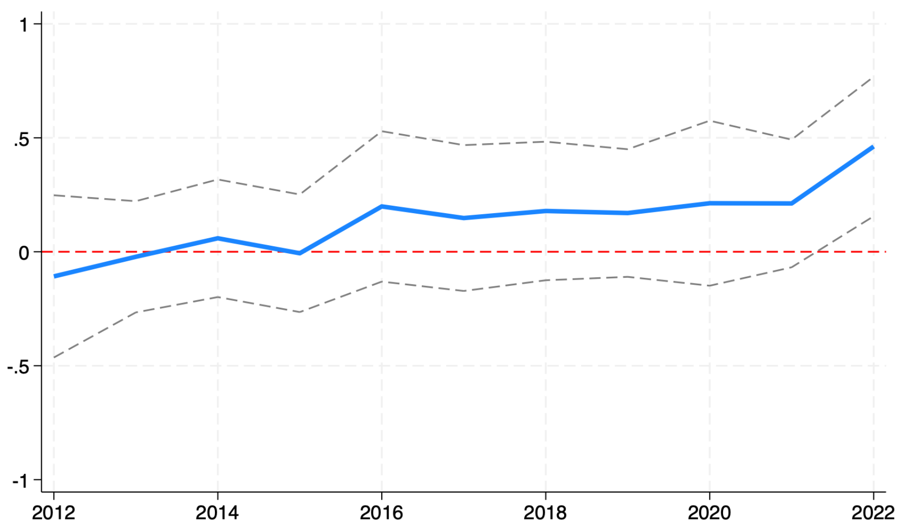
We begin by taking this to the data by exploring whether the weight that countries place on geopolitical closeness has changed relative to the weight that they put on other determinants of trade, before turning to industry heterogeneity. We run a series of regressions of the form

$$x_{iJn't} = \exp(\gamma_{iJt} + \gamma_{Jn't} + \sigma_{Jt} \log \alpha_{iJn'} + \theta_t \zeta_{nn't}) \epsilon_{iJn't}. \tag{A.11}$$

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).[6] 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 A.1, 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 B.1 reports the full regression results for 2013, 2016, 2019, and 2022.[7]

Figure A.1: Time Variation in Geopolitical Weight, θ_t



Notes: This figure reports the estimates of θ from the PPML estimation of equation (A.11). The solid line is the point estimate and the dashed lines are two standard error bands.

The model's gravity structure in equation (A.10) 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

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

[7] 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.

Table B.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

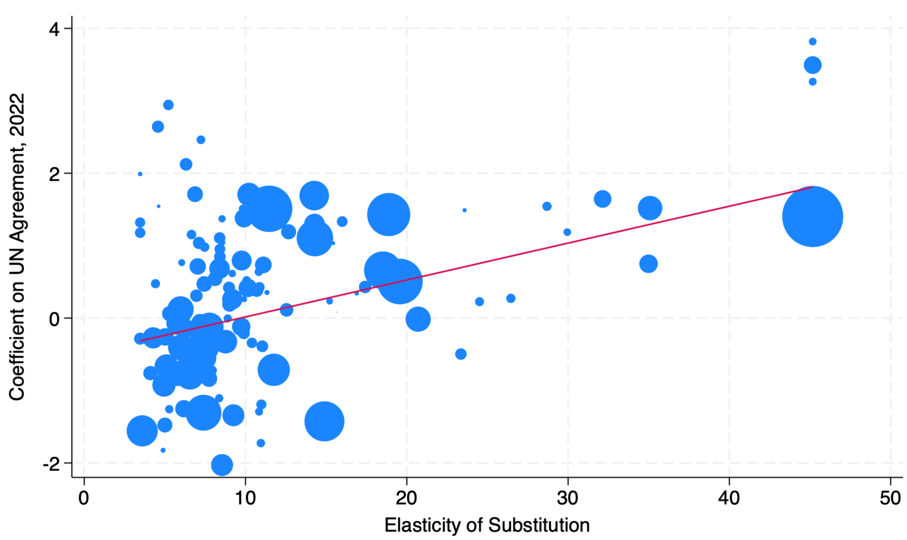
Notes: The table reports regression results from equation A.11, estimating using the package of Correia et al. (2020).

of substitution of goods within an industry. To do so, we run regressions of the form

$$x_{iJn'} = \exp(\gamma_{iJ} + \gamma_{Jn'} + \sigma_J \log \alpha_{iJn'} + \theta_J \zeta_{nn'})\epsilon_{iJn'}. \tag{A.12}$$

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

Figure A.2: Geopolitical Closeness and the Elasticity of Substitution, 2022



Notes: This plots the estimated θ (y-axis) from estimating equation A.12 in 2022 against the elasticity of substitution from Fontagné et al. (2022) aggregated to the ISIC level.

Figure A.2 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 A.2 visually confirms the strong positive relationship implied by the model, Table B.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 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.[8] Indeed, this simple uni-variate regression can explain nearly 30% of the variation in industry heterogeneity in the importance of geopolitics.

Table B.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 A.12 in 2022 against the elasticity of substitution from Fontagné et al. (2022) aggregated to the ISIC level.

A.3.6.2 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,

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

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

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 15, we have

$$\log x_{iJn} \approx \gamma_{iJ} + \gamma_{Jn} + \sigma_J \log \alpha_{iJn} + \theta \sigma_J \epsilon_J \frac{1}{1+\eta_i}\zeta_{mn}. \tag{A.13}$$

While equation (A.13) 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.

A.3.6.3 Proof of Proposition 15

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

$$P_{iJ} = \sum_{iJn} \left(\alpha_{iJn}^{\sigma_J} p_{iJn}^{1-\sigma_J}\right)^{-\frac{1}{\sigma_J-1}} \tag{A.14}$$

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

$$x_{iJn} = \left(\frac{\alpha_{iJn}}{p_{iJn} P_{iJ}}\right)^{\sigma_J} X_{iJ}. \tag{A.15}$$

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.3.7 Alternate Calibrations, Disaggregated Sectors, Details of Trade and Service Data

Bilateral trade data and input-output tables are routinely used in economic research but also well-known to have measurement issues. The issues revolve around the quality of the raw data (particularly for services) and the way missing information is imputed. Rather than provide a full overview of the issues since many are known in the literature, we focus here on a summary and emphasize those issues that are more likely to affect our results.

To compute our estimates of geoeconomic power in Section 5, we use several datasets. We use goods trade data from BACI, service trade data from the OECD-WTO Balanced Trade in Services (BaTIS), and domestic gross output data for all sectors from the OECD Inter Country Input Output (ICIO) tables. We investigated some of the underlying data sources that these datasets use, such as the UN Commodity Trade Statistics Database (COMTRADE), the WTO-UNCTAD-ITC Annual Trade in Services Database, as well as national sources such as the BEA for the U.S..

BACI, BaTIS, and the OECD ICIO tables have many procedures in common. For example, starting from the raw data, they fill in many of the trade observations by mirroring imports and exports. If country X does not report exporting to country Y, but country Y reports importing from country X, then this latter value is filled in (mirrored) for the export of country X.[9] This mirroring procedure is common and mostly improves the coverage of the data. Beyond this and simple corrections of mistakes in the raw data, the datasets differ in how much more information they fill in and how. BACI and BaTIS perform more interpolations and checks of disaggregated versus aggregated data. BaTIS in particular reports three versions of its data: Reported Value, Balanced Value, and Final Value. The Reported Value closely follows the raw data from the underlying data sources, the Balanced Value include mirroring and other basic interpolations, the Final Value includes estimates generated by gravity models[10] The input output tables, like ICIO, manipulate the data much further since they aim to estimate a balanced system in which every good or service produced has a corresponding use either domestically or internationally. Since the raw data are far from balanced, the production of input output tables involves multiple layers of estimation.

Given this imperfect but useful landscape of international trade data, we decided to base our benchmark estimates on datasets that include the most obvious corrections of the raw data (like mirroring, and basic error correction) but exclude model-based estimates (like those coming from a gravity model). The distinction is not always clear cut, but this is the general aim. For example, the BaTIS Balanced may use some information from BaTIS final. This led us to use BACI for goods, BaTIS Balanced Value for services, and the ICIO for the domestic absorption share. In this appendix, we show how our results change if we use different (combinations of) datasets or different data concepts within the same dataset. We considered the following combinations:

1. Benchmark estimates as in the main body of the paper, but use BaTIS Reported Value rather than Balanced Value for services (Figure A.3)

2. Use ICIO for both exports/imports and domestic data (Figure A.5)

Using BaTIS Reported Values for services in Figure A.3 leads to a substantial increase in U.S. and American Coalition power, with the increase coming from finance power. This is to be expected since in BaTIS Reported Value the U.S. accounts for a substantially higher share of foreign financial services purchased by most target countries, as it tends to be among the most frequent reporters. Indeed, Figure A.4 shows that the fraction of expenditures on foreign financial services accounted for by the U.S. is much higher in the Reported Value than in the Balanced Value version of the BaTIS data. The actual dollar value of expenditures on U.S. financial services is not much different between Balanced Value and Reported value since both essentially use the data published by the U.S. BEA. The major difference arises from the denominator in the fraction, the dollar value spent on all foreign financial services. Many countries have irregular reporting, and the BaTIS balancing procedure fills in many of these values compared to the raw reported data. Given the large increase in the U.S. controlled share of finance services in the Reported Value data, the even larger increase in estimated power is a reminder of the nonlinear nature of power. The U.S. controlled share is already high using the Balanced Value, further increases coming from using the Reported Value lead to disproportionally large increases in power.

Using ICIO for both domestic and international data in Figure A.5 leads to relatively similar results to those in the main body of the paper that use our benchmark data choices. Using only the ICIO tables has the advantage of a single dataset that is internally consistent. It has the

[9]The details differ across datasets on the exact calculation and adjustments to the data performed while mirroring.

[10]See the BaTIS manual for full documentation.

disadvantage that the ICIO tables use many more estimation procedures to balance the data and those cannot be easily unwound or inspected since the data are provided with a single methodology, with no variations coming from different sets of assumptions.

Financial Services. The data on financial services and insurance are of particular interest in this paper. Conceptually, the data on financial services and insurance can be divided into two components: directly and indirectly measured. Directly measured financial services account for those services for which a fee is paid directly. For example, the fee for a payment, security transaction or custody, or the management of assets. Financial Intermediation Services Indirectly Measured (FISIM) include those services for which there is no observable fee directly associated with the service but for which a fee is nonetheless paid indirectly by adjusting other elements of the transaction. For example, opening and maintaining a bank account might have no direct fee, but a fee is nonetheless paid via a lower interest rate on deposit. To measure the value of these services indirectly, statisticians have to estimate what the interest rate would have been if no service was provided by the bank account.[11] This indirect measurement is of course fraught with difficulties, especially in the presence of risk and liquidity premia.

The statistical discussion above also brings up the economic issue of which parts of finance our paper aims to capture. Our basic focus is on financial services at the core of the international financial architecture: payment systems, security transaction and settlement, custody and management of assets, trade financing and insurance, etc. We focus on these basic services because they play a large role in geoeconomics and sanctions.[12] As explained in the paper, their basic nature means that they affect many other activities (e.g. the ability to make a payment) and have therefore large economic effects. In practice, they are also heavily controlled by the U.S.-led coalition making them a natural chokepoint for threats and sanctions. We also include insurance and pension services both because they are related to these basic services and because in some datasets only the combination of financial services and insurance and pension services is reported in an aggregate finance service category. We are not focusing on other aspects of finance, which are also interesting, like seizing assets or preventing particular investments on national security grounds (either inbound or outbound investments).

There are several basic issues with the service data. For example, they are more likely based on surveys rather than transaction data. One issue is that for many countries the data can not be disaggregated to focus on sub-components of particular interest. Second, we would ideally like to separate directly and indirectly measured services. Both because indirectly measured services are more noisily estimated and because they could capture elements of finance that are further away from the economics of this paper. While this is not possible systematically across many countries, the BEA produces detailed breakdowns for the U.S.. Table B.3 shows that for the U.S. the FISIM component is relatively small at 27bn compared to 149bn of explicitly charged financial services in 2023. The largest individual subcategories are "Financial management services," "Credit card and other credit-related services," and "Securities lending, electronic funds transfer, and other services."

[11] See the BPM6 manual and the statistical annex for a full discussion of the statistical procedures.

[12] The BPM6 manual indeed explains that: "Financial services cover financial intermediary and auxiliary services, except insurance and pension fund services. These services include those usually provided by banks and other financial corporations. They include deposit taking and lending, letters of credit, credit card services, commissions and charges related to financial leasing, factoring, underwriting, and clearing of payments. Also included are financial advisory services, custody of financial assets or bullion, financial asset management, monitoring services, liquidity provision services, risk assumption services other than insurance, merger and acquisition services, credit rating services, stock exchange services, and trust services."

We have emphasized that the U.S.-led coalition accounts for a high share of expenditures of most countries on foreign financial services. We conjecture that aggregating all financial services and insurance together understates the underlying concentration in crucial financial services like international payments. On the other hand, the presence of omitted data on financial services could skew the concentration. Two possible concerns are: (1) financial services from the China-led coalition are systematically understated, (2) small countries do not collect the data on services.

The first concern is most pressing when looking at countries politically close to China since they could be using more financial services from China that are not currently measured. For example, there is ample anecdotal evidence of Russia relying more on China for payments since the war in Ukraine. There are good reasons to believe that these transactions are not fully accounted for in international trade datasets, in particular since both China and Russia have interest in not disclosing such sensitive data. For example, in Figure 8 we have to rely on the WTO estimates of the level and composition of financial services imports from Russia. In many cases the underlying reported data is both sparse and noisy.

The second concern was highlighted above in our discussion of BaTIS Balanced versus Reported Values and Figure A.4. In more balanced datasets (like BaTIS Balanced Values or ICIO) the expenditure shares on U.S. finance are systematically lower and many more bilateral relationships are populated with non-zero values.

Alternative Calibration of the Elasticities. Despite being one of the most important parameters in international trade, the sector level elasticities σ_J are notoriously hard to pin down in the data and there is little consensus in the literature. Our approach is to take the estimates directly from the literature, and then show the reader how the results change with different ranges of the elasticities.

In the benchmark results of the paper, we we set the composite bundle of all goods and non-financial services elasticity to $\sigma_M = 6$ to deliver a trade elasticity of 5 as in Costinot and Rodríguez-Clare (2014) and the financial services bundle to $\sigma_F = 1.76$ following Rouzet et al. (2017). We set $\varsigma_G = \frac{\sigma_G}{2}$ for $G = M, F$ to account for the domestic variety being a relatively worse substitute for the bundle of foreign varieties than each foreign variety is with respect to other foreign varieties, as discussed in Feenstra et al. (2018).

To transparently visualize how the results change with the elasticities Figure A.6 plots the level of power and Figure A.7 the fraction of power attributable to the financial sector for the U.S., the American Coalition, China, and the Chinese Coalition. In these figures we fix the expenditure shares to be the averages of the data in 2019, and then vary the elasticities σ_M and σ_F. In particular, we calibrate the share of expenditures on financial services to be 5%, non-finance 95%, the share of spending on foreign financial services to be 15% and the share of spending on foreign non-finance to be 21%. These values corresponds to unweighted cross-country average values in 2019. For each of the four hegemonic coalitions (each panel), we calibrate the share of finance and non-finance that falls on the coalition, ω_F and ω_M to be: 5% and 15% for China, 21% and 8% for the United States, 6% and 19% for the Chinese coalition, and 71% and 41% for the American coalition. This corresponds to the unweighted cross-country average values in 2019. We vary the elasticity σ_M between 3 and 8 and the elasticity σ_F between 1.3 and 4.

Figure A.6 illustrates clearly the result that as the elasticities increase the power falls since the target country is able to substitute the inputs it has lost access to with other inputs from countries outside the hegemonic coalition that are relatively similar. Panels (a) and (b) focusing on the U.S. and American Coalition differ strikingly with Panels (c) and (d). The difference is driven by the heterogeneity in what the U.S. and China control. For the U.S., Panels (a) and (b) highlight that power increases fast as the finance elasticity lowers. The same is not true (quantitatively) for China in Panels (c) and (d) because the fraction of financial services controlled by China is so small that even a low finance elasticity does not result in much power. On the other hand, China's power increases strongly as σ_M lowers since China controls high expenditure shares in that bundle. Figure A.6 confirms these patters by displaying the fraction of overall power that arises from the finance services.

We provide two more explorations of what different elasticities would imply for the main results of the paper. Figure A.8 shows the distribution of power across target countries when the finance elasticity is lowered to 1.2. There is a substantial jump up in power, the more so for those target countries for which an hegemonic coalition has a high expenditure share. Figure A.9 shows that overall power decreases when we set ς equal to σ, that is we set the domestic variety to be as substitutable with the bundle of foreign varieties as the foreign varieties are substitutable with each other. Since in the paper we set $\varsigma = \frac{1}{2}\sigma$, setting the two elasticities to be the same disproportionally lowers the importance of sectors that have low elasticities σ, like finance, in the power calculations.

Disaggregated Sectors. In the main body of the paper we aggregated all non-finance sectors together. A more aggregated approach has the advantage of making the formulas and results easier to understand and inspect as well as rely less on noisy disaggregated data. The issues discussed above for bilateral and sector level trade and input-output data as well as the elasticity estimates are magnified by going to finer disaggregated sectors. Yet, disaggregation is important for the economics of the paper since chokepoints might occur at finer levels of disaggregation and impact the aggregates, and these chokepoints are lost to the analysis when using a coarser definition of sectors.

In this appendix we begin by using the same data choices made in the paper (BACI for goods, BaTIS Balanced for services, ICIO for domestic absorption) but allow for more sectors. In particular, we used the ICIO goods sectors, and separate services into either financial services or a composite "other services." For this calculation, we used the sectoral elasticity estimates from Fontagné et al. (2022), kept the elasticity of substitution of finance to 1.76, and set the other services sector to the mean of other sectors. The results are reported in Figure A.10. While the results are broadly similar to those in the main body of the paper, the disaggregation in general increases the power coming from non-finance sectors for the U.S. and decreases it for China. The Fontagné et al. (2022) elasticities do not immediately correspond to the value of 6 set in our aggregate results, rather it turns out that China (more than the U.S.) has higher expenditure shares in sectors with relatively high elasticities.

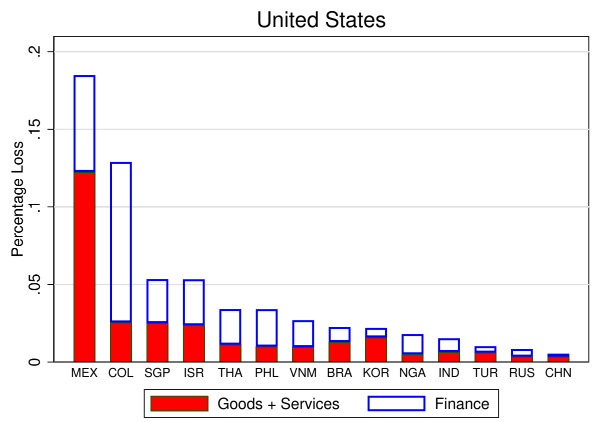
In addition, we calculate power using the disaggregated ICIO data for both exports and domestic shares and report the results in Figure A.11. The results are again broadly similar.

Table B.3: U.S. Financial and Insurance Services Export Overview

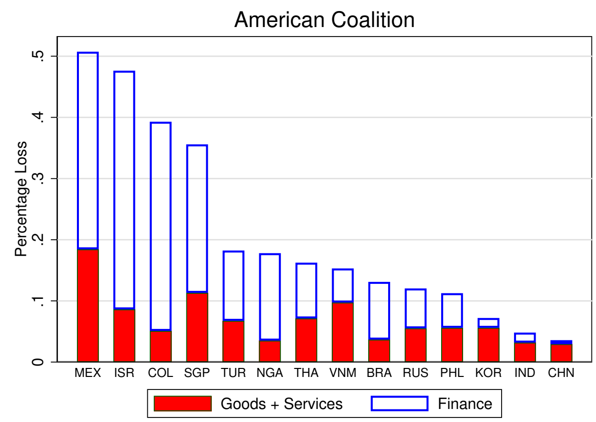
	2020	2021	2022	2023
Insurance services	20	23	24	25
Direct insurance	2	2	2	3
Reinsurance	16	18	19	19
Auxiliary insurance services	2	3	3	3
Financial services	151	172	167	175
Explicitly charged and other financial services	132	153	145	149
Brokerage and market-making services	11	12	10	10
Underwriting and private placement services	4	5	2	2
Credit card and other credit-related services	24	29	33	38
Financial management services	61	69	65	62
Financial advisory and custody services	8	10	7	7
Securities lending, electronic funds transfer, and other services	24	28	28	29
Financial intermediation services indirectly measured	19	19	23	27

Notes: The table reports data for Insurance services and Financial Services from the BEA Table 2.1. U.S. Trade in Services, by Type of Service. Values are in billions of U.S. dollars.

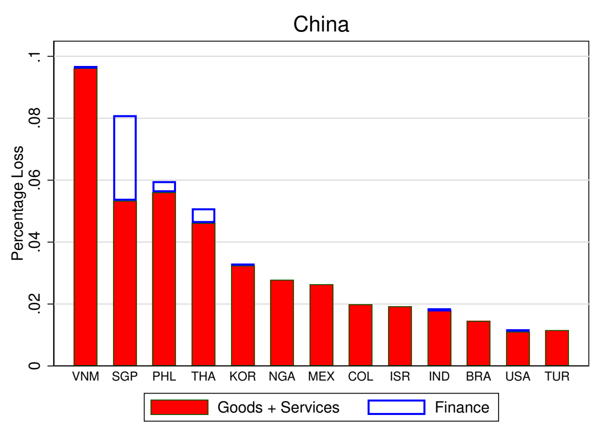
Figure A.3: **USA and China Geoeconomic Power, BaTIS Reported Value Data**



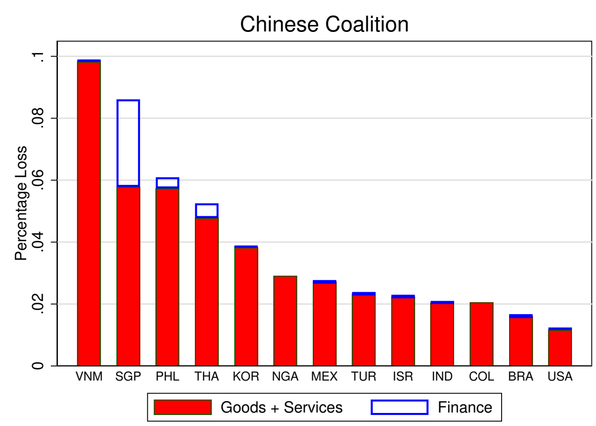
(a) United States



(b) American Coalition



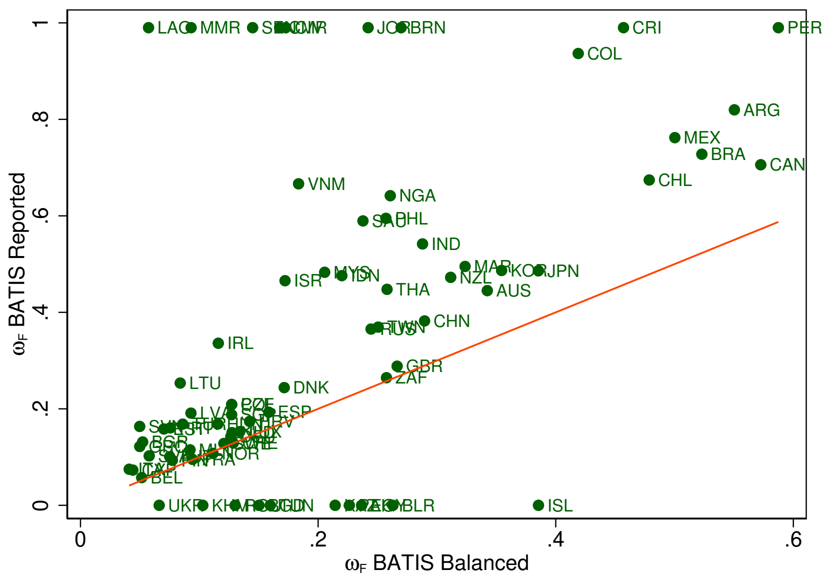
(c) China



(d) Chinese Coalition

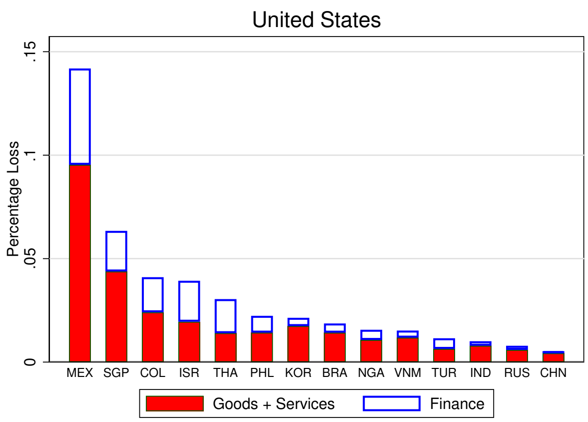
Notes: This figure plots estimates of power as in equation (20) using the BaTIS Reported Value (rather than Balanced Value) data. The vertical axis measures in percentage (log) points the economic loss to the country on the corresponding bar of the horizontal axis. The solid red bar is the loss arising from withholding all goods trade and non-finance services. The hollow blue bar is the loss arising from withholding financial services. The hegemon coalition making the threat is the (a) USA, (b) American Coalition, (c) China, (d) Chinese Coalition.

Figure A.4: U.S. Share of Foreign Expenditures on Finance Services, BaTIS Reported and Balanced Values

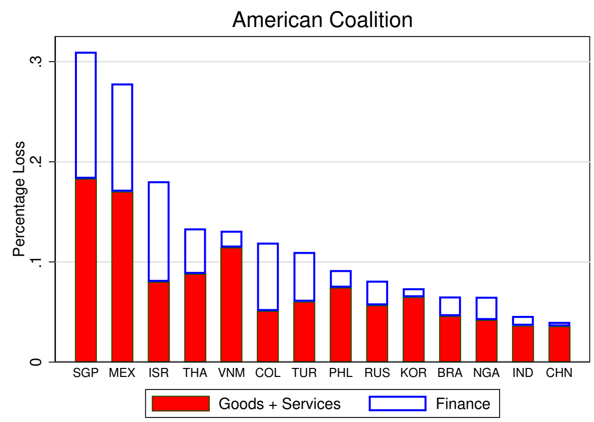


Notes: Figure plots the U.S. share of expenditure on foreign finance services for a number of countries, using the Reported and Balanced Values in the BaTIS data in 2019.

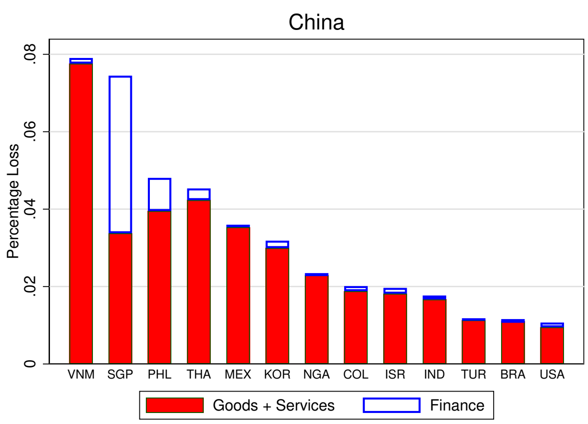
Figure A.5: **USA and China Geoeconomic Power, ICIO**



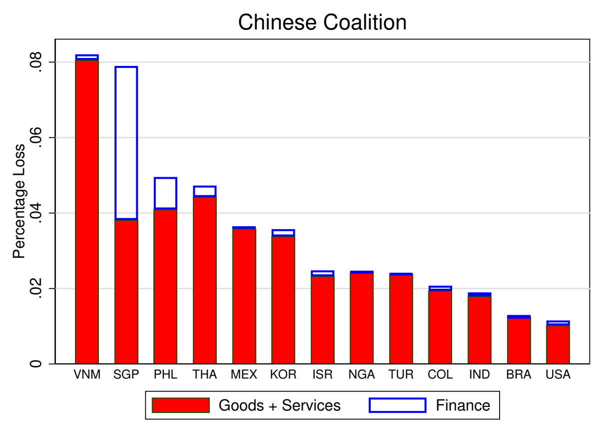
(a) United States



(b) American Coalition



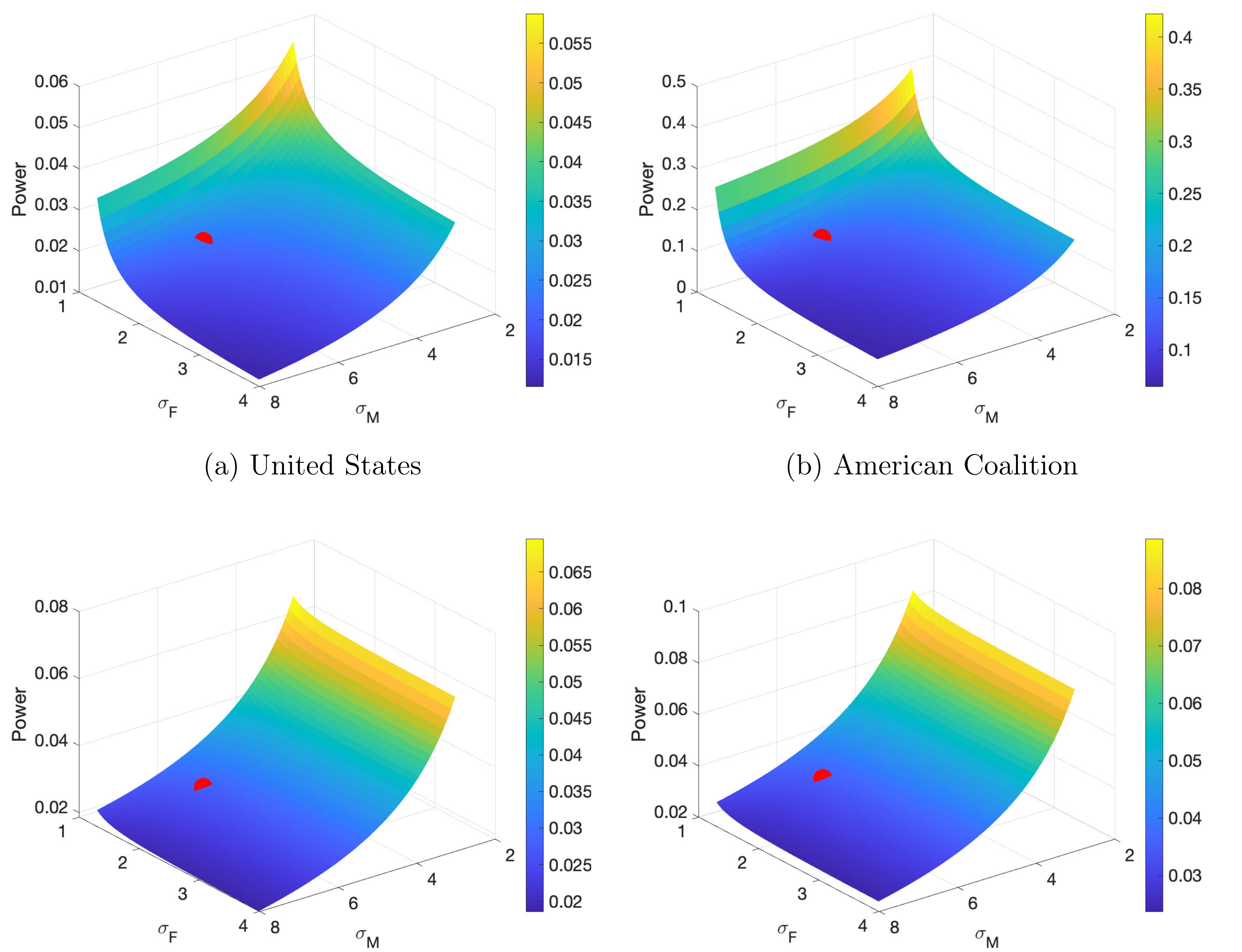
(c) China



(d) Chinese Coalition

Notes: This figure plots estimates of the power as in equation (20) using export data from ICIO instead of BaTIS. The vertical axis measures in percentage (log) points the economic loss to the country on the corresponding bar of the horizontal axis. The solid red bar is the loss arising from withholding all goods trade and non-finance services. The hollow blue bar is the loss arising from withholding financial services. The hegemon coalition making the threat is the (a) USA, (b) American Coalition, (c) China, (d) Chinese Coalition.

Figure A.6: **Power and The Elasticity of Substitution**



(a) United States

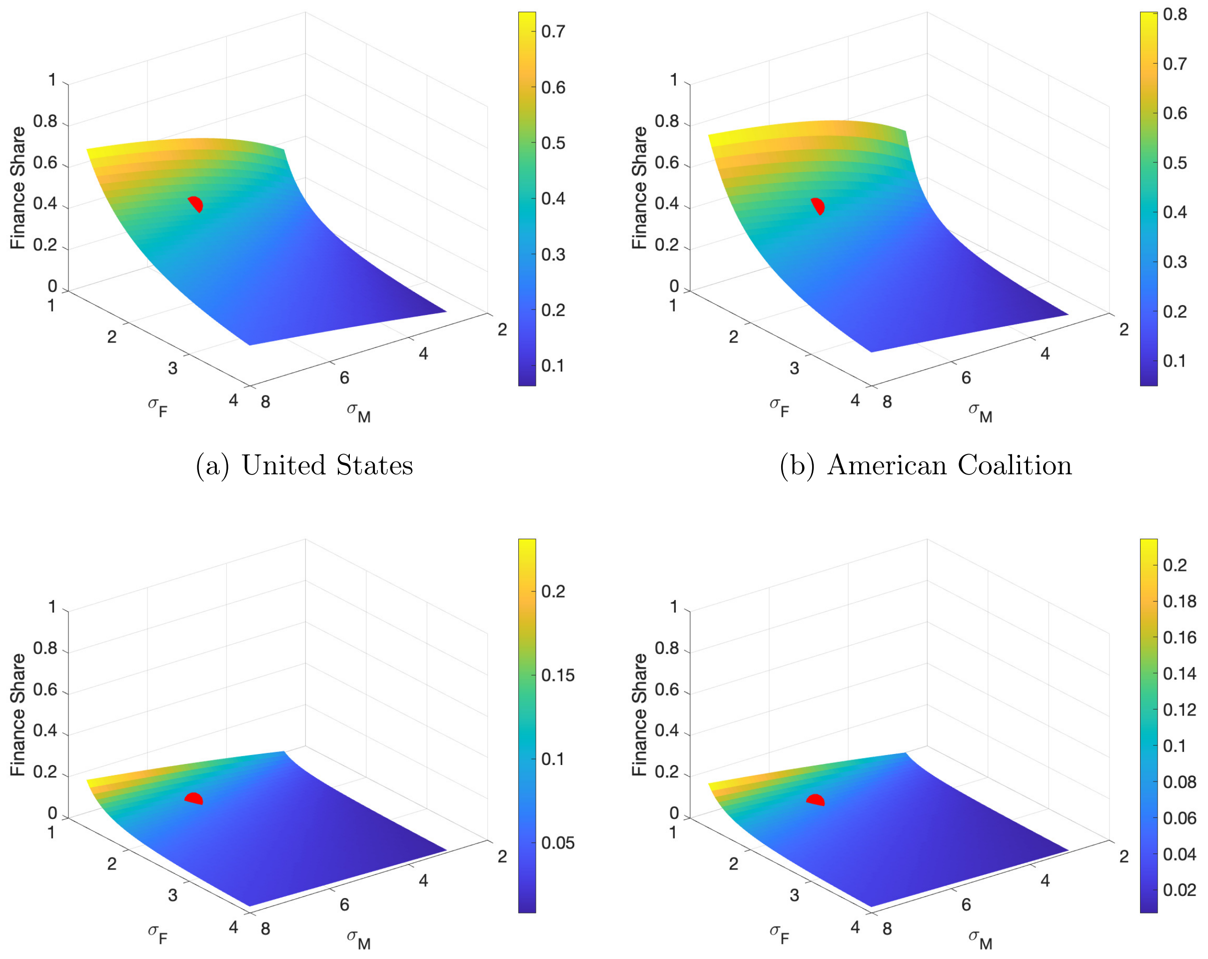
(b) American Coalition

(c) China

(d) Chinese Coalition

Notes: This figure plots levels of power as in equation (20) for different levels of the the elasticity of substitution of financial services (σ_F) and nonfinance (σ_M). The hegemon coalition making the threat is the (a) USA, (b) American Coalition, (c) China, (d) Chinese Coalition. The red dot corresponds to our basline calibration with $\sigma_F = 1.76$ and $\sigma_M = 6$. We calibrate the share of spending on financial servies to be 5%, nonfinance 95%, the share of foreign spending on financial services to be 15% and the share of foreign spending on nonfinance to be 21%. This corresponds to an unweighted cross-country average in 2019. For each of the four hegemon coalitions, we calibrate the share of finance and nonfinance they control, ω_F and ω_M, to the be the unweighted cross-country average in 2019.

Figure A.7: **The Share of Financial Power and the Elasticities of Substitution**



(a) United States

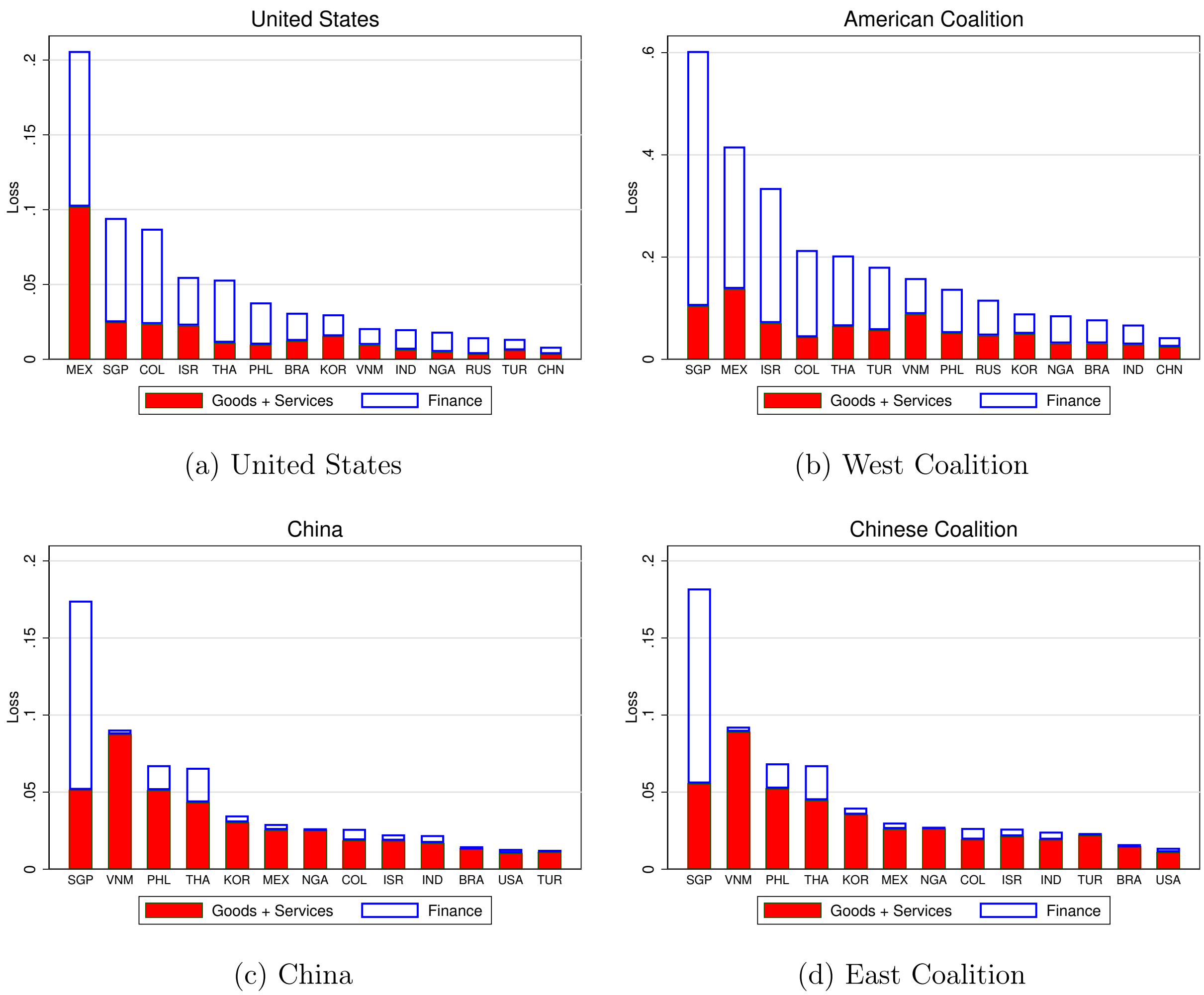
(b) American Coalition

(c) China

(d) Chinese Coalition

Notes: This figure plots the share of hegemonic power coming from finance. The hegemon coalition making the threat is the (a) USA, (b) American Coalition, (c) China, (d) Chinese Coalition. The red dot corresponds to our basline calibration with $\sigma_F = 1.76$ and $\sigma_M = 6$. We calibrate the share of spending on financial servies to be 5%, nonfinance 95%, the share of foreign spending on financial services to be 15% and the share of foreign spending on nonfinance to be 21%. This corresponds to an unweighted cross-country average in 2019. For each of the four hegemon coalitions, we calibrate the share of finance and nonfinance they control, ω_F and ω_M, to the be the unweighted cross-country average in 2019.

Figure A.8: **Geoeconomic Power, Alternative Finance Calibration, 2019**



(a) United States

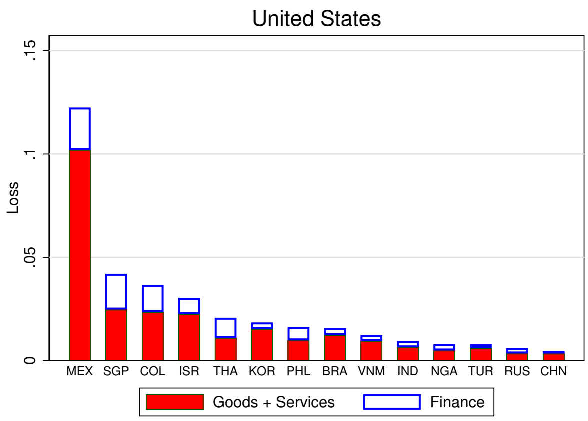
(b) West Coalition

(c) China

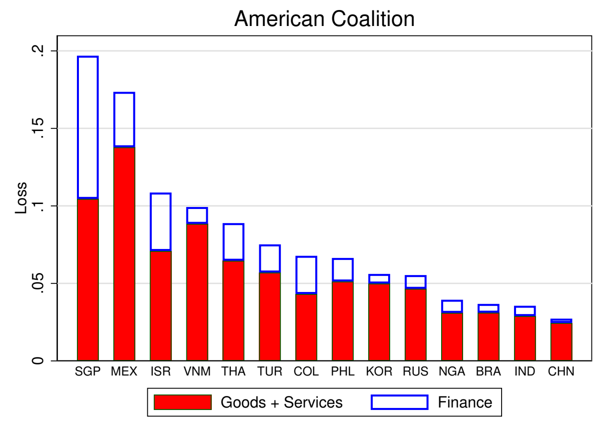
(d) East Coalition

Notes: The figure plots estimates of power as in equation (20). The vertical axis measures in percentage (log) points the economic loss to the country on the corresponding bar of the horizontal axis. The solid red bar is the loss arising from withholding all goods trade and non-finance services. The hollow blue bar is the loss arising from withholding financial services. The hegemon coalition making the threat is the (a) USA, (b) West Coalition, (c) China, (d) East Coalition. In this calibration, we follow the Koijen and Yogo (2020) of a demand elasticities of 1.2 (for equities) to calibrate the elasticity of substitution of financial services. In addition, we assume that foreign and home financial services are Cobb-Douglas with $\varsigma_F = 1$. Finally, we set $\varsigma_M = 6$.

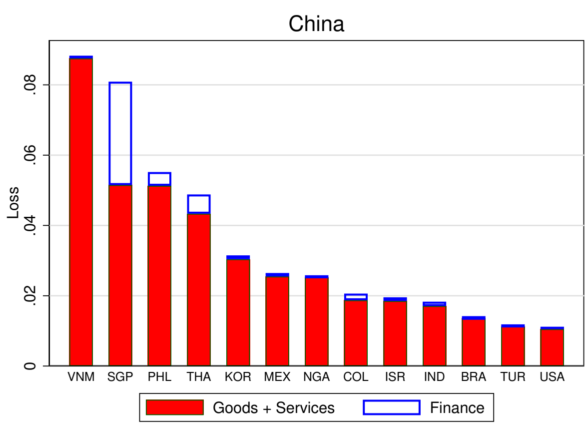
Figure A.9: **Geoeconomic Power, $\varsigma = \sigma$, 2019**



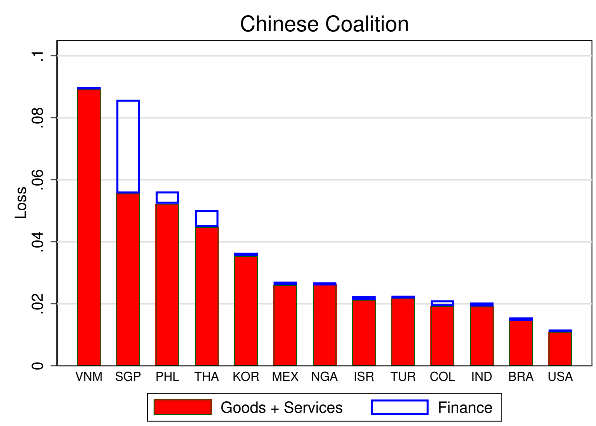
(a) United States



(b) West Coalition



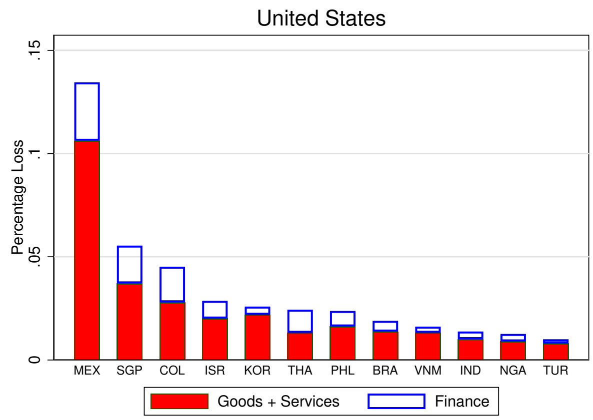
(c) China



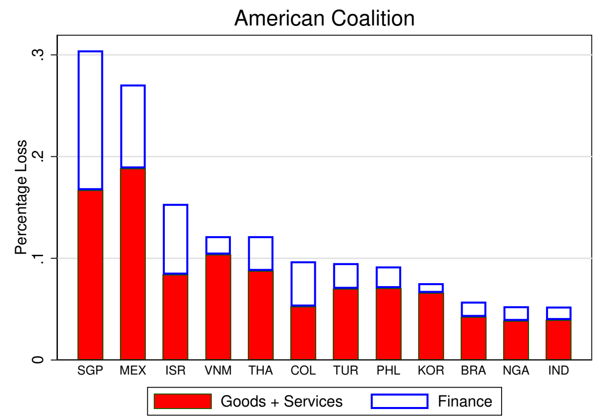
(d) East Coalition

Notes: The figure plots estimates of power as in equation (20). The vertical axis measures in percentage (log) points the economic loss to the country on the corresponding bar of the horizontal axis. The solid red bar is the loss arising from withholding all goods trade and non-finance services. The hollow blue bar is the loss arising from withholding financial services. The hegemon coalition making the threat is the (a) USA, (b) West Coalition, (c) China, (d) East Coalition. In this calibration, we set $\varsigma_f = \sigma_f = 1.76$ and $\varsigma_m = \sigma_m = 6$.

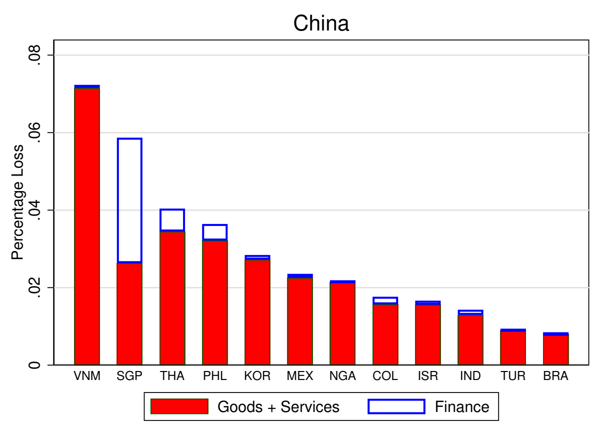
Figure A.10: **USA and China Geoeconomic Power, BACI/BATIS and ICIO Sectoral**



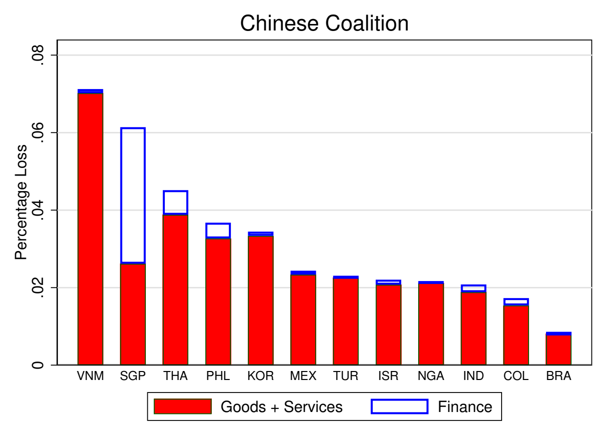
(a) United States



(b) American Coalition



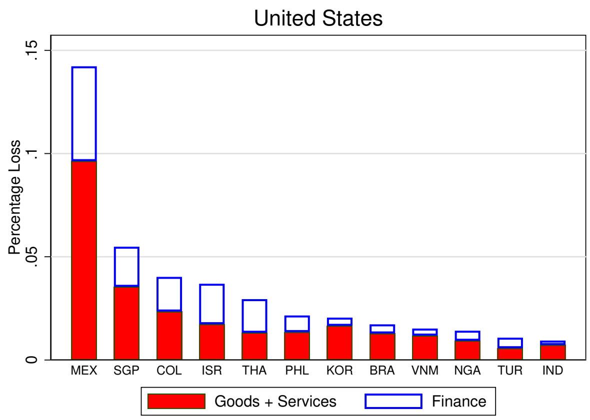
(c) China



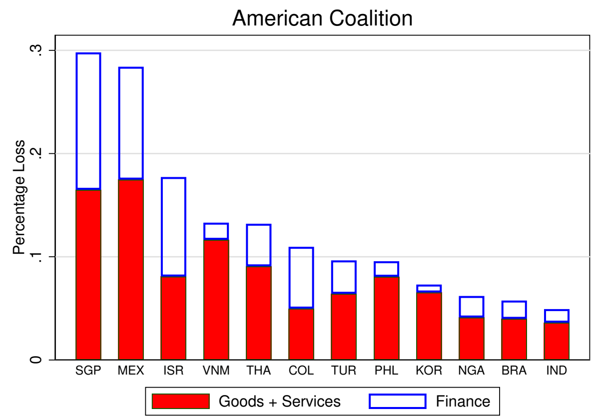
(d) Chinese Coalition

Notes: This figure plots estimates of power as in equation (19) using service trade data from BATIS and goods trade data from BACI. The vertical axis measures in percentage (log) points the economic loss to the country on the corresponding bar of the horizontal axis. The solid red bar is the loss arising from withholding all goods trade and non-finance services. The hollow blue bar is the loss arising from withholding financial services. The hegemon coalition making the threat is the (a) USA, (b) American Coalition, (c) China, (d) Chinese Coalition. This figure considers a disaggregated version Calibrated multi-sector version using BACI and BATIS data for exports and ICIO for domestic shares. Elasticities of substitution from Fontagné et al. (2022), $\rho_M = 3, \varsigma = (1/2)\sigma, \varrho = 1$.

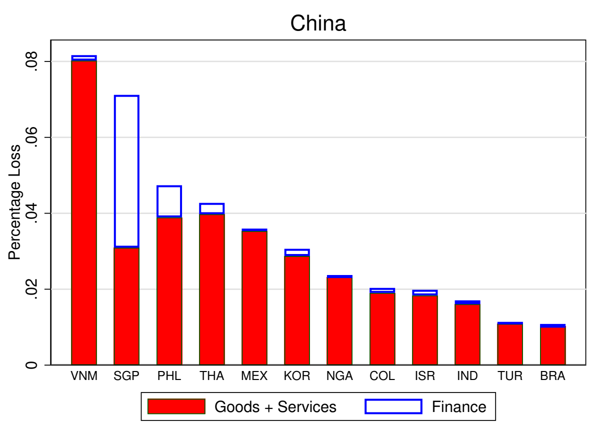
Figure A.11: **USA and China Geoeconomic Power, ICIO Sectoral**



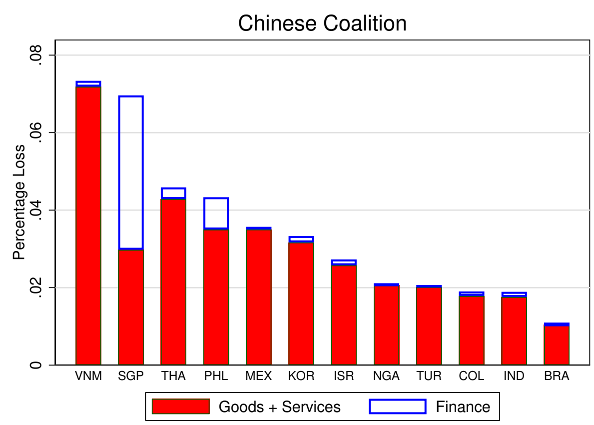
(a) United States



(b) American Coalition



(c) China



(d) Chinese Coalition

Notes: This figure plots estimates of power as in equation (19) using trade data and domestic production data from OECD ICIO. The vertical axis measures in percentage (log) points the economic loss to the country on the corresponding bar of the horizontal axis. The solid red bar is the loss arising from withholding all goods trade and non-finance services. The hollow blue bar is the loss arising from withholding financial services. The hegemon coalition making the threat is the (a) USA, (b) American Coalition, (c) China, (d) Chinese Coalition. This figure considers a disaggregated version Calibrated multi-sector version using BACI and BATIS data for exports and ICIO for domestic shares. Elasticities of substitution from Fontagné et al. (2022), $\rho_M = 3, \varsigma = (1/2)\sigma, \varrho = 1$.