A Theory of Economic Coercion and Fragmentation

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Abstract

Global powers, like the United States and China, exert influence on other countries by threatening the suspension or alteration of financial and trade relationships. We show that the mechanisms that generate gains from integration and specialization, such as external economies of scale, also increase these countries' power to exert economic influence because in equilibrium they make other relationships poor substitutes for those with a global hegemon. We study how smaller countries can insulate themselves from geoeconomic pressure from the great powers by pursuing anti-coercion policy. We show that while an individual country can make itself better off, uncoordinated attempts by multiple countries to limit their dependency on the hegemon lead to unwinding the global gains from integration and fragmenting the global financial and trade system. Countries resort to inefficient home alternatives the more so hegemons are expected to want to exert their influence in disruptive ways. We study a leading application focusing on financial services and payment systems as both a tool of coercion by the hegemon and an industry with strong strategic complementarities at the global level. We show empirically that the geoeconomic power of the United States relies strongly on financial services while that of China loads more on manufacturing trade.

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1 Introduction

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

In this paper, we show that traditional rationales for the gains from integration, such as economies of scale and gains from specialization, can lead to interdependent global systems that become instruments of economic coercion. For example, a US controlled global payments system can be economically efficient due to strong strategic complementarities in international payments but give the US power over countries around the world to threaten suspension or reduction of access. While this generates a strong incentive for individual countries to generate domestic alternatives to these hegemon-controlled inputs and systems, we show that uncoordinated pursuit of anti-coercion policies such as subsidies on home alternatives can fragment the global economy, destroying the gains from trade and financial integration. We show that the resulting fragmentation is inefficient as each country over-protects its own economy.

We present a model of the world economy with input-output linkages among productive sectors located in different countries. Crucially, we allow for both production externalities, such as external economies of scale or strategic complementarities in the usage of some inputs, and externalities on consumers, which allow us to capture geopolitical spillovers. Our model features a hegemonic country that can use threats to stop or alter the provision of inputs to other entities to induce them to take costly actions as in Clayton, Maggiori and Schreger (2023). These actions take the form of monetary transfers to the hegemon, tariffs or quantity restrictions on trade of goods or services, and political concessions and cover the most frequently used actions in geoeconomics in practice. Because the hegemon has no direct legislative control over foreign entities, the hegemon's power to induce these entities to agree to its demands is limited by a participation constraint, reflecting that the cost of compliance cannot exceed the cost of losing access to the hegemon's network. In practice secondary sanctions often put forward to targeted entities a stark choice: comply or stop doing business with the hegemon and its network.

Our main analysis studies the interaction between the policies and threats of the hegemon and those of the countries in the rest of the world. All countries, including the hegemon, simultaneously

[1] See the June 2023 announcement and January 2024 proposals. Relatedly, see the G7 governments communique on Economic Resilience and Economic Security.

adopt domestic policies before the hegemon makes its threats and demands (formally, offers its contract). Formally, these domestic policies are a complete set of revenue-neutral taxes that a country can impose on its domestic firms. For example, a government could impose a tax on its firms for purchasing the hegemon's goods, or could provide a subsidy on 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 change in the behavior of private agents, but also through the change in the contract offered by the hegemon. We refer to domestic policies adopted for the purpose of altering the hegemon's offered contract as anti-coercion policies.

We show that the hegemon's optimal contract to every foreign entity leaves the foreign party's welfare equal to its outside option of not using the inputs controlled by the hegemon. Crucially, this means that the hegemon has an incentive to increase a firm's profits when it takes the offer (before transfers) while also reducing the profits they would earn if they decline the offer and stick to their outside option. This motivates the hegemon to internalize the production externalities of the foreign firms it can influence because doing so increases the hegemon's power over these firms. In this way, the pure self-interest of the hegemon leads it to behave in some ways akin to a global planner. At the same time, however, the hegemon also takes steps to reduce the value of firms' outside options. Doing so increases the hegemon's power over these foreign firms. Such a policy from the hegemon can include a demand that trading with the hegemon involves reducing the use of domestically produced alternative goods. 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.

We show that optimality of anti-coercion tools hinges on the ability of a country to engineer changes in general equilibrium prices and quantities in ways that increase the outside option of their own firms. We show that in a world in which such amplification is not present, the hegemon uses its power only to demand monetary transfers. In such a world, countries do not adopt anti-coercion policies because such policies reduce their outside option. This makes them worse off even if, in the process, they reduce the hegemon's power. We also study how the hegemon implements domestic policies to build up its power over foreign entities. In particular, the hegemon targets general equilibrium changes that increase the gap in foreign entities' inside and outside options, and places particularly large weights on maximizing this gap for entities over which it particularly values having more power.

We apply our theory to study the global financial system as a tool of coercion. We focus on the role of global payments systems and explore the role that alternative payment systems can play as anti-coercion tools. We consider a world in which firms in a country can use both a domestic payment system and also a global one provided by the hegemon. A key characteristic of a payments system in our application is that it exhibits strong strategic complementarities in

adoption: each firm finds a system more attractive the more other firms use that same system. We capture gains from international integration by assuming that the hegemon's global system features an international strategic complementarity from adoption, whereas home alternatives can only be used by domestic firms and so only feature a local strategic complementarity. This set-up captures the notion of a globally efficient payment system and multiple home versions that are imperfect substitutes. We show that, in the absence of anti-coercion policy, the hegemon uses its power to induce foreign firms to shift away from their domestic alternative and towards the hegemon's global system. The hegemon thus coordinates global financial integration and induces firms to internalize the global strategic complementarity. At the same time, the hegemon excessively integrates the global payment system in order to reduce the attractiveness of alternative payment systems. This excessive financial integration 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 taxes on use of the hegemon's system and subsidies on use of the home alternative. From a positive perspective, we show that increased use of either instrument generates fragmentation in the global economy: not only domestic firms but also foreign firms reduce use of the hegemon's system in response to a country increasing anti-coercion. Intuitively, stronger anti-coercion measures make it more costly for the hegemon to demand a country's firms excessively integrate on to its system. Moreover, once one country reduces reliance on the global system, the strategic complementarity in its adoption becomes more muted, increasing the cost to the hegemon of excessively integrating other countries and so reducing its demands that other countries do so. In this case, the strategic complementarity that promoted greater integration unwinds, leading to greater fragmentation globally.

We show that each country individually finds it optimal to fully fragment from the hegemon, providing an efficient subsidy to the home alternative while also imposing maximal tariffs on use of the hegemon's system. Intuitively, countries' outside option depends on the value of their home alternative, which is reduced by their domestic firms using 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-coericon. Intuitively, even though the hegemon can achieve gains in total surplus globally by coordinating adoption of its system, its use of that system as an instrument of coercion leaves every country worse off, motivating anti-coercion and fragmentation.

Although our main application focuses on the global financial system and the payment system in particular, our general results illustrate that underlying economics applies to any industry featuring strategic complementarities. For example, external economies of scale can be present in information technologies both in software and hardware, and it is an open question whether artificial intelligence will fall into this category. Moreover while our application focuses on technological externalities in production, our main results show that the hegemon also uses price based propagation as a mecha-

nism for building power. For example, while it could be efficient to locate most basic manufacturing in China due to low costs of labor and economies of scale, such allocation of production could increases China's ability to conduct economic coercion through prices. Each country, with little or no manufacturing left domestically, would find that deviations on the margin from China's demands are too costly. Countries react by implementing anti-coercion policy and as a result re-balance to producing using an inefficient home manufacturing base.

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

Finally, we demonstrate that our model generates a gravity structure in which the wedges imposed by the hegemon and individual countries act as endogenous distortions to a standard gravity equation. When geopolitical preferences enter each country's government objective function via externalities, we show that the time-varying coefficient on geopolitical alignment corresponds to the weight that countries place on their own geopolitical preferences in shaping their trade relationships. Consistent with the recent surge in geopolitical tensions, we find that the weight on geopolitical alignment increased sharply in 2022. We then provide support for an empirical prediction of the model: the degree to which trade is shaped by geopolitical alignment should be dependent on the elasticity of substitution of each good. Finally, we demonstrate how this structural gravity framework offers the possibility of identifying where hegemons are exerting their influence most strongly, providing empirical guidance for future work on characterizing the macro-strategic importance of various industries. While the empirical findings here are suggestive, this section demonstrates how our framework can provide guidance for empirical work that aims to characterize the role of geoeconomics and geopolitics in driving fragmentation.

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

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

Our paper also contributes to a growing empirical literature exploring the relationship between geopolitical tensions and fragmentation of global trade and investment. Our paper contributes by deriving a structural gravity equation linking country and hegemon preferences that serves as a guide for this style of empirical work, as well as providing a structural interpretation to these regressions. Contributions in this area include 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 monetary system. Bahaj and Reis (2020) and Clayton et al. (2022) study China's attempt to internationalize its currency and bond market.

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

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_f^ℓ. 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 $U_n(C_n) + u_n(z)$, where $C_n = \{C_{ni}\}_{i \in \mathcal{I}}$ and where z is a vector of aggregate variables which we use to capture externalities a la Greenwald and Stiglitz (1986). Individual consumers take z as given. We assume U_n is increasing, concave, and continuously differentiable. The representative consumer in each country owns all domestic firms and the endowments of local factors. The representative consumer of country n faces a budget constraint given by:

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

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

Firms. A firm in sector i located in country n produces output y_i using a subset $\mathcal{J}_i$ of intermediate inputs and the set of local factors of country n, $\mathcal{F}_n$. Firm i's production function is $y_i = f_i(x_i, \ell_i, z)$, where $x_i = \{x_{ij}\}_{j \in \mathcal{J}_i}$ is the vector of intermediate inputs used by firm i, x_{ij} is the use of intermediate input j, $\ell_i = \{\ell_{if}\}_{f \in \mathcal{F}_n}$ is the vector of factors used by firm i, and ℓ_{if} is use of local factor f. Firms take the aggregate vector z as given. We further assume that f_i is increasing, strictly concave, satisfies the Inada conditions in (x_i, ℓ_i), and is continuously differentiable in (x_i, ℓ_i, z). The sector-specific production function f_i allows us to capture technology, but also transport costs, and

relationship specific knowledge.

We define the firm's profit function, if it were restricted to produce using only a subset $\mathcal{J}_i' \subset \mathcal{J}_i$ of intermediate goods, as

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

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

Market Clearing, Externalities, and Equilibrium. Denote $D_j = \{i \in \mathcal{I} \mid j \in \mathcal{J}_i\}$ the set of sectors that source from sector j, i.e. the sectors immediately downstream from j. Market clearing for good j is given by

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

Market clearing for factor f in country n is

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

We assume that the vector of aggregates takes the form $z = \{z_{ij}\}$. In equilibrium $z_{ij}^* = x_{ij}^*$, where we use the $*$ notation to stress it is an equilibrium value. That is externalities are based on the quantities of inputs in bilateral sectors i and j relationships. This general formulation can be specialized to cover pure external economies of scale externalities, in which it is the total output of a sector that matters, or export-import externalities, in which it is the fraction of output sold cross border that matters, but also thick market externalities, in which it is the extent to which an input is widely used by many sectors that matters.[3]

A competitive equilibrium of the model are prices for goods and factors P and allocations $\{x_i, C_n, y_i, \ell_i, z_{ij}\}$ such that: (i) firms maximize profits, given prices; (ii) households maximize utility, given prices; (iii) markets clear.

2.1 Hegemon, Target Countries, and Geoeconomic Policies

Each country n has a government that conducts domestic policy. We select a country, denoted m, to be a world hegemon. In addition to setting domestic policies, the hegemon can seek to impose policies on foreign sectors. In order to get a foreign firm to adopt its policies, the hegemon can threaten to exclude that foreign firm from buying a subset of inputs. The model has a Stackelberg

[3]It is without loss of generality to assume that firm-to-firm sales, y_{ij}, do not cause externalities, since $x_{ji} = y_{ij}$ already captures such sales on the buyer side. It is straightforward to allow the z to also capture externalities coming from factor usage or consumption.

structure. First, all countries simultaneously choose domestic policies. Then, the hegemon makes take-it-or-leave-it offers to foreign firms.

Every country's government, including the hegemon, has domestic policy instruments that consist of a complete set of revenue-neutral Pigouvian taxes ("wedges") $\tau_{n,i} = \{\{\tau^x_{n,ij}\}_{j\in\mathcal{J}_i}, \{\tau^\ell_{n,if}\}_{f\in\mathcal{F}_n}\}$ for each domestic firm $i \in \mathcal{I}_n$, where $\tau^x_{n,ij}$ is the bilateral tax on purchases by firm i of good j and $\tau^\ell_{n,if}$ is the bilateral factor tax. We use the first subscript n to index the country imposing the tax. 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.[4]

Pigouvian wedges capture many policies that governments pursue on their domestic firms such as industrial policy(subsidies and taxes on certain sectors) and trade policy (subsidies and tariff on foreign sourcing of goods). We assume that governments have full control of their domestic firms and can simply impose the desired wedges, but have no ability to impose wedges on entities in other countries (a power distinctive of the hegemon). The Pigouvian wedges provide countries one way of pursuing anticoercion policies, for example encouraging production and domestic alternatives to the inputs controlled by the hegemon, while also allowing the hegemon to pursue policies (both domestically an internationally) that bolster its position.[5]

2.2 Hegemon Problem

A single country, denoted m, is a hegemon in the model. The hegemon can offer take-it-or-leave-it contracts that require firms to take costly actions. The hegemon can threaten to cut off supply to firms that reject its contract.

Hegemon Contract. Recalling that D_i is the set of sectors downstream from sector i, let $\mathcal{C}_m = \bigcup_{i\in\mathcal{I}_m} D_i \backslash \mathcal{I}_m$ denote the set of foreign sectors that source at least one input from the sectors in the hegemon's country. We assume that the hegemon can contract with all these downstream foreign firms, $i \in \mathcal{C}_m$.[6]

Hegemon m makes a take-it-or-leave-it offer to each firm $i \in \mathcal{C}_m$. The contract offered to firm i has three components: (i) a nonnegative transfer T_i from firm i to the hegemon's representative consumer; (ii) revenue-neutral wedges $\tau_{m,i} = \{\{\tau^x_{m,ij}\}_{j\in\mathcal{J}_i}, \{\tau^\ell_{m,if}\}_{f\in\mathcal{F}_n}\}$ on purchases of inputs and

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

[5] Another potential tool, apart from domestic wedges, that governments other than the hegemon could adopt would be a transfer-based anticoercion tool, which is a 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.

[6] Since the hegemon (like all other countries) can directly mandate domestic policies, we do not need to consider the hegemon offering contracts to its domestic firms.

factors, with equilibrium revenues $\tau^x_{m,ij}x^*_{ij}$ 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* $\mathcal{J}'_i$, that is a restriction to only use inputs $j \in \mathcal{J}'_i$ if firm i rejects the hegemon's contract. We denote $\Gamma_i = \{T_i, \tau_{m,i}, \mathcal{J}'_i\}$ 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 $\mathcal{J}'_i$.

Feasible Punishments. 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 their immediately downstream sectors. In other words, punishments can be undertaken only via the hegemon's domestic firms and foreign firms that the hegemon contracts with.[7]

Definition 1 *A punishment $\mathcal{J}'_i$ is **feasible** under direct transmission if $\mathcal{J}_i \backslash (\mathcal{I}_m \cup \mathcal{C}_m) \subset \mathcal{J}'_i$.*

We define $\underline{\mathcal{J}'_i} = \mathcal{J}_i \backslash (\mathcal{I}_m \cup \mathcal{C}_m)$ to be the maximal punishment that the hegemon can achieve under direct transmission.

Firm 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.

If firm i rejects the hegemon's contract, it achieves value

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

where (x^o_i, ℓ^o_i) 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[8]

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

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

For firm i to accept the contract, it must be better off under the contract than by rejecting it. This gives rise to the **participation constraint** of firm i,[9]

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

[7] It is straightforward to extend analysis to other relevant definitions of feasibility, for example that the hegemon can only threaten punishments using its own domestic firms.

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

[9] We could extend our analysis to allow a split of surplus between the hegemon and firm, rather than all surplus going to the hegemon.

so that the participation constraint compares the hegemon's contract with transfers, wedges, and access to all inputs to the outside option with corresponding punishment inflicted by the hegemon. Slackness in this constraint when the hegemon demands no costly actions is achieved by a punishment that decreases the right hand side. The participation constraint places a limit on the total private cost of costly actions that the hegemon can demand of a firm it contracts with.

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

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

The hegemon chooses contract terms Γ to maximize its utility, subject to firms' participation constraints (equation 3) and feasibility of punishments.[10]

Optimality of Maximal Punishments. Our model's tractability allows for a sharp characterization of the off-path punishments the hegemon threatens. The optimal off-path punishment is the largest that the hegemon can achieve.

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

Intuitively, the hegemon always imposes the maximum punishment possible for rejecting its contract because for any firm that accepts its contract, the hegemon could always implement the same allocation as under a weaker punishment through an appropriate choice of wedges.

2.2.1 Optimality of Binding Participation Constraints

The presence of the transfer (side payment) T_i from firms to hegemons' consumers suggests that every participation constraint should bind. However, this result is not immediate: redistributing wealth from the country n consumer to the country m consumer also potentially introduces changes in equilibrium prices and aggregates if the country n consumer has a different consumption basket than consumer m. To ease exposition in the main text, we introduce the following assumption that we maintain throughout the main text.

Assumption 1 *All consumers $n = 1, \ldots, N$ have identical homothetic consumption preferences, that is $U_n(C_n) = U(C_n)$ where U is homothetic.*

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

Assumption 1 implies that the optimal composition of consumption out of one unit of wealth is identical across countries, and therefore wealth transfers among consumers do not induce relative price changes in goods. We can then prove the following result.

Lemma 2 *Under the hegemon's optimal contract, the participation constraint binds for each firm $i \in \mathcal{C}_m$, that is*

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

Lemma 2 is valuable because it equivalently tells us that firm i retains surplus equal to its outside option, $V_i^o(\underline{\mathcal{J}}_i')$. Lemma 2 also implies that the hegemon cares directly about the value generated by the inside option compared to the outside option, that is $V_i(\tau_m, \mathcal{J}_i) - V_i^o(\underline{\mathcal{J}}_i')$, because the hegemon extracts this difference in the form of a transfer T_i. All else equal, this implies the hegemon receives higher value (in the form of transfer payments) when the firm's on-path value $V_i(\tau_m, \mathcal{J}_i)$ increases or when its outside option $V_i^o(\underline{\mathcal{J}}_i')$ falls. This also highlights part of the trade-off between introducing wedges and extracting transfers, since wedges have the direct effect of lowering the inside option of firm i and, consequently, lowering the transfer T_i extracted.

2.2.2 Hegemon's Optimal Wedges

Given Lemma 2, we can write the hegemon's problem as maximizing its representative consumer's utility

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

subject to the non-negativity constraint on transfers (arising from the participation constraint of firms),

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

The proposition below characterizes the input wedges $\tau_{m,ij}^x$ that the hegemon demands of foreign firms $i \in \mathcal{C}_m$ in its optimal contract (with factor wedges characterized in the proof).[11]

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

[11] This proposition extends Proposition 3 in Clayton et al. (2023) to allow for pre-existing domestic policies implemented by all countries, including the hegemon.

on input j given by

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

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

The optimal tax formula of the hegemon is decomposed into two lines. Both lines reflect a wealth-equivalent marginal benefit of mitigating the activity correction (the numerator) divided by the wealth-equivalent marginal cost of the correction. The common denominator of the two lines is the total wealth-equivalent marginal cost, $1+\frac{1}{\frac{\partial W_m}{\partial w_m}}\eta_i$. This captures the direct cost of losing transfer revenue from tightening the participation constraint, 1, and also the wealth-equivalent shadow cost of tightening the transfer nonnegativity constraint, $\frac{1}{\frac{\partial W_m}{\partial w_m}}\eta_i$. If the transfer received from firm i is strictly positive, then $\eta_i = 0$ and so the marginal cost (denominator) is equal to 1.

The marginal benefit contained in the first line consists of three conventional optimal policy terms. The firm term, "private distortion," reflects how changes in the equilibrium prices and aggregates induced by changes in activities of firm i result in changes in the activities of firms in the hegemon's country. If the allocations of these firms were not distorted, $\tau_{m,k} = 0$, this effect would be zero by Envelope Theorem. However, to the extent these firm's allocations are distorted from their private optimum by the hegemon's domestic policies, the hegemon values their loss in private profits according to the magnitude of the distortion, $\tau_{m,k}$. The second term, "Domestic z-externalities," reflects spillovers to domestic firms and consumers from changes in aggregate quantities. The third term, "Terms-of-Trade," reflects the motivation for the country to manipulate its terms of trade with foreign countries, boosting prices in goods for which the country is net exporters ($X_{m,k} > 0$) and lowering prices in goods for which the country is a net importer ($X_{m,k} < 0$).

The marginal benefit contained in the second line consists of benefits that come through how changes in equilibrium prices and quantities change how much power the hegemon has over foreign firms through changes in slack in their participation constraints. Even though the set of inputs the hegemon is cutting off remains fixed, the hegemon's power is endogenous through changes in the equilibrium. These effects for each firm are upweighted by that same marginal cost $1+\frac{1}{\frac{\partial W_m}{\partial w_m}}\eta_i$, meaning that the hegemon effectively places a higher weight on firms for which it has a higher shadow value η_i of relaxing their participation constraint. The hegemon values the spillover of changes in z and P not only to the inside option of the profits of these firms, but also (negatively)

to the outside option. That is, the hegemon perceives a higher marginal benefit if the induced equilibrium change *raises* a firm's inside option or *lowers* its outside option. In this manner, the hegemon uses optimal wedges applied to a sector i to influence the power it has over all foreign firms. Our main application to payments systems (Section 4) focuses on how a hegemon leverages a strategic complementarity in adoption to increase its power both by raising the inside option of firms that use its system and accept its contract, and to lower the outside option of firms that reject the hegemon's system and contract. In general, power is also built through endogenous prices, for example by making the hegemon's inputs cheaper and so more costly to substitute away from.

The optimal tax formula depends on network amplification, $\frac{dz}{dx_{ij}}$ and $\frac{dP}{dx_{ij}}$, that occurs as prices and aggregates change as a firm changes its behavior. For conciseness, we characterize this network amplification in the proof of Proposition 1. In Section 3.1, we provide a detailed characterization of network amplification from the ex ante perspective that includes how changes in domestic policies affect the terms of the hegemon's contract.

2.3 Leading Simplified Environments

To build intuition for our model it is at times useful to simplify the modeling environment by shutting off several channels. This will also be helpful in separately highlighting the driving forces behind the results. We consider two classes of simplifications going forward. First, a "constant prices" environment in which we switch off terms-of-trade manipulation incentives. Second, 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 so that it can easily be referred to in the rest of the paper. Our main results do not use these simplified environments.

Definition 2 *The **constant prices** environment assumes that consumers have linear preferences over goods, $U = \sum_{i \in \mathcal{I}} \tilde{p}_i C_{ni}$, and that each country has a local-factor-only firm with linear production $f_i(\ell_i) = \sum_{f \in \mathcal{F}_n} \frac{1}{\tilde{p}_i} \tilde{p}^{\ell}_f \ell_{if}$. We assume consumers are marginal in every good and factor-only firms are marginal in every local factor so that $p_i = \tilde{p}_i$ and $p^{\ell}_f = \tilde{p}^{\ell}_f$.*[12]

Definition 3 *The **no z-externalities** environment assumes that $u_n(z)$ and $f_i(x_i, \ell_i, z)$ are constant in z.*

3 Optimal Anti-Coercion Policy

Our main analysis studies the pursuit of anti-coercion policies by foreign governments. Given the Stackelberg structure, each country n chooses policies on its own firms, internalizing how the hegemon's offered contract will change but taking as given the policies adopted by all other countries.

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

While each country n has a number of incentives for imposing policies (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 policies set by the hegemon on its worn firms, again isolating the component aimed at build up its hegemonic power.

The government of country n chooses policies τ_n in order to maximize its representative consumer's utility, The objective function implicitly embeds the hegemon's optimal contract, and how equilibrium objects adapt to changes in anti-coercion policies. We leave implicit the dependency of the hegemon's contract and equilibrium objects on anti-coercion policies to avoid cumbersome notation.

Using Lemma 2, we can equivalently write the objective of country n as

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

Whereas the hegemon values the gap between a foreign firm's on-path profits and its outside option, the government of country n values that firm's outside option. Thus whereas the hegemon has an incentive to increase on-path profits and reduce the outside option, the government of country n has an incentive to increase its outside option (but not on-path profits).

3.1 Network Propogation and Anti-Coercion

We first show that our economy has an input-output structure in which amplification occurs not only via prices and z-externalities, but also by how the hegemon adapts its contract to changes. The adaptation of the hegemon's contract in particular to changes in the policies of foreign countries is central to studying the role for anti-coercion measures.

Suppose we enter 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 results in equilibrium aggregates (τ_m, P, z^*), where τ_m is the hegemon's ex post wedges, P is the vector of equilibrium prices, and z^* the vector of equilibrium aggregates. We characterize below the effect of an exogenous perturbation in an arbitrary constant e on these aggregates.[13]

Proposition 2 *The aggregate response of z^* and P to a perturbation in ex-post constant e is*

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

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

[13] This proposition extends Proposition 2 in Clayton et al. (2023) by studying the endogenous response not only of aggregates, but also of the hegemon's contract.

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 2, so that amplification occurs only through z-externalities and responses of the hegemon's optimal contract. In this case, equation (7) reduces to

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

The first term on the right-hand side starts from the partial equilibrium demand response $\frac{\partial x}{\partial e}$ of all firms to the exogenous perturbation e, which is also the partial equilibrium response of z^* since $z^* = x^*$ in equilibrium. However, the partial equilibrium effect z^* is amplified in the presence of production externalities as other firms change their demand as a consequence. 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 taxes it imposes on firms it contracts with (it also demands transfer changes, but these do not affect the equilibrium owing to identical homothetic preferences). These changes in hegemon taxes in turn elicit partial equilibrium demand responses from firms, $\frac{\partial x}{\partial \tau_m}$, that then filter through the same Leontief amplification Ψ^z.

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

3.2 Optimal Anti-Coercion

We now turn to characterizing optimal domestic policies. It is notationally convenient to define Π_i^o to be firm profits at the outside option for all $i \in \mathcal{I}_n$, where naturally the outside option of firms $i \notin \mathcal{C}_m$ is defined to be the same as their inside option since they do not contract with the hegemon. The following proposition characterizes optimal policy of country n.[14]

Proposition 3 *The optimal domestic policy of country* n *satisfies*

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

[14] Proposition 3 provides necessary conditions for optimality.

where $\boldsymbol{x}_n^o = (x_i^o, \ell_i^o)$*, where* $\frac{d\boldsymbol{x}_n^o}{d\tau_n} = \frac{\partial \boldsymbol{x}_n^o}{\partial \tau_n} + \frac{\partial \boldsymbol{x}_n^o}{\partial z}\frac{dz}{d\tau_n} + \frac{\partial \boldsymbol{x}_n^o}{\partial P}\frac{dP}{d\tau_n}$*, and where* $\frac{dz}{d\tau_n}$ *and* $\frac{dP}{d\tau_n}$ *are defined by Proposition 2, and where* X_n^o *is the vector of hypothetical total country* n *exports of goods* $i \in \mathcal{I}$ *and factors* $f \in \mathcal{F}_n$ *if firms were to operate at their outside option – that is* $X_{n,i}^o = \mathbf{1}_{i \in \mathcal{I}_n} y_i^o - \sum_{i' \in \mathcal{I}_n} x_{i'i}^o - C_{ni}$ *and* $X_{n,f}^o = \bar{\ell}_f - \sum_{i \in \mathcal{I}_n} x_{if}^o$*.*

Proposition 3 presents the optimal tax formula of country n in a marginal cost/marginal benefit trade-off. The left-hand side of the tax formula is the direct marginal cost of a change in domestic wedges: the amount private production is already distorted, τ_n, times the additional distortion in private production *at the outside option* from a perturbation, $\frac{d\mathbf{x}_n^o}{d\tau_n}$.

The right-hand side of the tax formula is the social benefit of changes in domestic wedges, which comprises two terms. The first term reflects the social benefit of a change in tax that induces equilibrium changes in the vector of aggregate quantities z. The total benefit of the change is the size of the change, $\frac{dz}{d\tau_n}$, times the marginal benefit of a change. This marginal benefit includes both the spillover to firm profits and also to consumer utility. Importantly, the spillovers to firms are evaluated at the outside options of those firms, which results from the fact that the hegemon holds every firm to its participation constraint. Country n is therefore motivated to manage externalities in a manner that bolsters its outside option. For example, country n will be motivated to bolster economies of scale within domestic industries relying on domestic inputs, but less or not at all so for inputs the hegemon would cut off and so firms would not have access to at the outside option. This force will feature prominently in our application in Section 4.

The size of the change, $\frac{dz}{d\tau_n}$, is decomposed based on Proposition 2. In particular, focusing on the case of constant prices (Definition 2) for intuition, we have

$$\frac{dz^*}{d\tau_n} = \underbrace{\Psi^z \frac{\partial x}{\partial \tau_n}}_{\text{Standard Intervention}} + \underbrace{\Psi^z \frac{\partial x}{\partial \tau_m}\frac{d\tau_m}{d\tau_n}}_{\text{Anti-Coercion}}.$$

The firm term, $\Psi^z \frac{\partial x}{\partial \tau_n}$, is a standard motive for intervention that arises even without a hegemon. This reflects not only the direct impact on quantities $x = z$ that arises from a change in wedges τ_n, but also input-output amplification that arises from propagation of externalities, summarized by the inverse matrix for externalities Ψ^z. However, in the presence of a hegemon, there is an additional term capturing anti-coercion policies. It reflects how the *hegemon*'s optimal wedges respond to changes in domestic policies, $\frac{d\tau_m}{d\tau_n}$, and how those changes in hegemonic policies propagate through the network. Note that these terms include not only changes in hegemon wedges applied to domestic firms, but also those applied in other countries. Focusing in particular on the subset of effects operating through wedges applied to a firm i in country n, we have

$$\frac{\partial x_i}{\partial \tau_{n,i}} + \frac{\partial x_{n,i}}{\partial \tau_{m,i}}\frac{d\tau_{m,i}}{d\tau_n} = \frac{\partial x_i}{\partial \tau_{n,i}}\left(\mathbb{I} + \frac{d\tau_{m,i}}{d\tau_n}\right)$$

where $\mathbb{I}$ is the identity matrix, and where the equality uses that the identity of the country imposing

the wedge is irrelevant to the firm's decision problem once subjected to it. From the perspective of domestic firms, anti-coercion thus operates around whether changes in the hegemon's wedges reinforce or counteract the direct policy change of country n.

The second term is the equilibrium impact through prices, which here manifests as terms-of-trade manipulation. Given that all firms are held to their outside options, terms-of-trade manipulation is therefore defined according to that outside option. That is, the "hypothetical exports" $X^o_{n,i}$ of country n for good i is domestic production at the outside option net of domestic use at the outside option (by both goods and consumers). Notably, terms of trade manipulation does *not* drop out for domestic factors: while consumer income depends on total factor supply, because firms are held to their outside option what matters for factor demand is demand by firms at the outside option, which need not add up to total factor supply (given a deviation to the outside option by any individual firm does not affect market clearing). Intuitively, an increase in the factor price could benefit the domestic economy if it redirects firm income to households as factor payments that would otherwise be extracted as a side payment by the hegemon.

To further build intuition, we present a simple example.

Example 1 (Constant Prices, Utility Spillovers) *It is useful to present the optimal tax formula under constant prices (Definition 2) and assuming there are only utility spillovers (i.e., f_i is constant in z). In this case, we have*

$$\tau_n \frac{\partial \boldsymbol{x}^o_n}{\partial \tau_n} = - \underbrace{\frac{\partial u_n}{\partial z}\frac{\partial x}{\partial \tau_n}}_{\text{Standard Pigou}} \underbrace{- \frac{\partial u_n}{\partial z}\frac{\partial x}{\partial \tau_m}\frac{\partial \tau_m}{\partial \tau_{n_0}}}_{\text{Anti-Coercion}}$$

The first term on the right-hand side is a standard Pigouvian correction of utility externalities. The second term is anticoercion policies aimed at manipulating utility externalities through changing the demands of the hegemon.

Tariffs on the Hegemon's Goods or Subsidies for Alternatives? The *direct* marginal private cost associated with a change $\tau^x_{n,ij}$ is given by the direct costs $\tau_{n,i}\frac{\partial \mathbf{x}^o_n}{\partial \tau^x_{n,ij}}$, which is the first component of the term on the left hand side of equation (9). Because firm i is held to its outside option by the hegemon, this corresponds to the direct costs of changes in $\tau^x_{n,ij}$ on that outside option. It is important to note therefore that if j is one of the hegemon's goods that will be cut off in case of contract rejection, then $\tau_{n,i}\frac{\partial \mathbf{x}^o_n}{\partial \tau^x_{n,ij}} = 0$. That is, there is no *direct* private cost to firm i's outside option from country n raising tariffs on a good the hegemon controls, precisely because the hegemon's contract holds that firm to its outside option. In contrast, a subsidy to firm i for using an alternative to the hegemon's good could potentially induce a similar shift in expenditure patterns as a tariff on the hegemon's good, but such a subsidy also distorts the firm's profits at the outside option. This suggests an advantage to anticoercion policies that take the form of tariffs (or

subsidies) on the hegemon's goods rather than subsidies on alternatives, since the former do not directly distort the outside option whereas the latter do.

This also suggests a force for international fragmentation, since tariffs on hegemon goods are in a sense cheaper for a country to implement. Our application to payments system in Section 4 shows how a country uses a combination of large tariffs and modest subsidies to reduce dependence on the hegemon's payment system and bolster its home alternative.

Costly Actions and Political Concessions. In our model, the transfer T_i can serve as a stand-in for non-economic objectives such as political lobbying or diplomatic concessions, where T_i is the cost to firm i of undertaking the lobbying/concession. Clayton et al. (2023) provides a mapping of this form.

3.2.1 Anti-Coercion Absent Network Amplification

To highlight the importance of amplification, we specialize Proposition 3 by shutting off endogenous prices and z-externalities. Formally, we assume our constant prices environment (Definition 2) and our no z-externalities environment (Definition 3). We obtain the following result showing that in this world, countries do not pursue anti-coercion policies.

Corollary 1 *Assume constant prices (Definition 2) and no z-externalities (Definition 3). Then, the optimal domestic policy of country n is $\tau_n = 0$.*

Corollary 1 shows that, when prices are constant and there are no z-externalities, there is no value to country n adopting anti-coercion policies. Intuitively, even though the hegemon is extracting the difference between the inside and outside options as a transfer payment, in absence of equilibrium price or externality effects the outside option is maximized by the firms private decisions. Anti-coercion policies could lower the value extracted by the hegemon, but in the process would also lower the value to country n. Indeed, the hegemon also optimally imposes no taxes in its contract, that is $\tau_m = 0$ as well.

The outcome of Corollary 1 coincides with a solution of a global planner that aims to maximize global welfare in the environment of constant prices and no z-externalities. The global planner's optimum is to maximize global wealth, with transfers being zero sum. Given the hegemon's extraction is a pure side payment, hegemonic power in absence of price or externality effects moves the world economy to a different point on the Pareto frontier but does not move to its interior. Anticoercion policies would only move to the interior of the Pareto frontier while also reducing the welfare of country n. The value of adopting anticoercion measures therefore rests on the ability to influence equilibrium prices and externalities.

3.3 Efficient Allocation and Noncooperative Outcome

To contextualize the outcome under hegemonic power and anti-coercion measures, we benchmark our results against two relevant cases. The first is the global planner's solution, which provides an efficiency benchmark. The second is the noncooperative outcome that would arise when all countries are able to set domestic policies, but no country is a hegemon.

Global Planner's Efficient Allocation. We assume that the global planner has the same instruments as individual governments and the hegemon, but maximizes global welfare. Formally, the global planner chooses domestic policies τ and a hegemon contract Γ to maximize global welfare,

$$\mathcal{U}^G = \sum_{n=1}^{N} \Omega_n \Big[W_n(p, w_n) + u_n(z) \Big], \tag{10}$$

subject to firms' participation constraints and punishment feasibility, and 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 $\Omega_n \frac{\partial W_n}{\partial w_n} = 1$. The following result characterizes the global planner's optimum.

Proposition 4 *The global planner's optimum can be implemented by offering a trivial contract* Γ *and applying input wedges given by*

$$\tau^x_{n,ij} = -\sum_{k \in \mathcal{I}} \frac{\partial \Pi_k}{\partial z_{ij}} - \sum_{n=1}^{N} \frac{1}{\frac{\partial W_n}{\partial w_n}} \frac{\partial u_n}{\partial z_{ij}} \tag{11}$$

Proposition 4 shows that the global planner uses domestic input wedges $\tau^x_{n,ij}$ solely for the purpose of correcting externalities arising from the vector of aggregate quantities z. In particular, given the global planner lacks a redistributive motive, the global planner ignores terms of trade effects, which redistribute wealth across countries but are at best zero sum.

There are three key differences between the global planner's wedges and those set by individual governments (Proposition 3). First, whereas individual country governments only set wedges to correct externalities borne by domestic firms and consumers, the global planner also accounts for externalities that fall upon firms and consumers in foreign countries. Second, individual country governments care about the externalities on their firms' outside options, due to extraction by the hegemon. In contrast, the hegemon cares about the externalities on firms' inside options. Third, whereas individual countries' tax formulas include network amplification, the global planner's optimal wedge $\tau^x_{n,ij}$ only accounts for the direct externality of an increase in x_{ij}, with no dependence on network amplification. Intuitively, this is because the global planner has a complete set of instruments on firms, and so can directly manage externalities associated with each activity separately.

In contrast, individual countries and the hegemon possess limited instruments, in that they can only control a subset of firms in the global economy. Although the global planner does internalize network amplification through prices, the resulting pecuniary externalities are purely redistributive and so do not generate a net welfare impact.

Proposition 4 shows that the global planner relies exclusively on wedges applied by each country to its domestic firms τ_n in implementing the global optimum, without relying at all on hegemonic power. Intuitively, the hegemon's ability to demand changes in wedges is redundant, since individual countries' policies are capable of implementing those same wedges themselves. The ability of the global planner to directly dictate taxes in each country thus renders unnecessary hegemonic power as an instrument for intervention and adjustment of wedges.

Proposition 4 illuminates how a hegemon can in certain ways resemble a global planner. The global planner uses wedges to correct the total z-externality to all firms and all consumers in the world. The hegemon uses wedges to correct externalities on its own economy, but also to correct externalities affecting the *surplus* that firms it contracts with receive relative to their outside option. The hegemon's motive to correct externalities is thus divided between the globally efficient goal of maximizing these firms' inside options, and the globally inefficient goal of minimizing these firms' outside options. Moreover, the hegemon does not consider at all externalities that fall on foreign consumers or on firms that it cannot contract with. In addition, the global planner values externalities across firms equally, whereas the hegemon places a greater weight on externalities that fall upon firms where its marginal value to power is higher. In this sense, the marginal value of power η_i reflects an endogenous notion of the alignment of the hegemon's interests with those of firm i in terms of maximizing the surplus of this firm. However, this notion of alignment is subtle, because it corresponds not only to a motivation to increase the inside option but also to minimize the outside option.

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 5 *Absent a hegemon, the optimal input wedges of country n satisfy*

$$\tau^x_{n,ij} = -\left[\sum_{k\in\mathcal{I}_n} \frac{\partial \Pi_k}{\partial z} + \frac{1}{\frac{\partial W_n}{\partial w_n}} \frac{\partial u_n}{\partial z}\right] \frac{dz}{dx_{ij}} - \sum_{k\in\mathcal{I}} X_{n,k} \frac{\partial p_k}{\partial P} \frac{dP}{dx_{ij}}$$

where $X_{n,k} = \mathbf{1}_{k\in\mathcal{I}_n} \cdot y_k - \sum_{i\in\mathcal{I}_n} x_{ik} - C_{nk}$ is exports by country n of good k.

The motives of the country n government in setting taxes on its domestic firms in the absence of a hegemon are similar in nature to those in the presence of a hegemon (Proposition 3). In particular, each country has a motivation to correct z-externalities that fall on the domestic economy and to shift equilibrium prices in its favor (terms-of-trade manipulation) based on that country's net

position in each input market. The key difference is that absent a hegemon, the government of country n values the inside option of all of its firms, rather than their outside option, and does not have a motivation for anti-coercion since there are no hegemonic interventions. The country n government deviates from the global planner's efficient wedges both in that it ignores externalities that fall outside of its country, and it engages in terms-of-trade manipulation. Thus absent either a hegemon or a global planner, policies are purely inward looking in the sense that they neglect welfare impacts on any foreign agent.

3.4 Hegemon's Optimal Domestic Policies

So far, we have focused on how a non-hegemonic country sets its domestic policies to protect itself from hegemonic influence. We conclude this section by characterizing how the hegemon sets taxes on its domestic firms to build up its hegemonic power.

Proposition 6 *The hegemon's optimal domestic input wedges satisfy*

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

Proposition 6 reveals that the hegemon's motivations for setting wedges on domestic firms parallel those of foreign countries in correcting domestic z-externalities and manipulating terms of trade. That is, the first line of equation (12) parallels the optimal input wedges in Proposition 3. However, in addition to these incentives, the hegemon also has an incentive to manipulate prices and aggregates to build its power over foreign firms (the second line of equation 12). This motivation parallels its incentive to use its optimal contract with foreign firms to ask them to take costly actions that built its power by manipulating the global equilibrium (Proposition 1).

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

4 Financial Services, Strategic Complementarities, and Fragmentation

We specialize the general framework derived in the previous section to both illustrate better the role of strategic complementarities in the production function 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 of SWIFT to monitor potential terrorists' financial transactions. The US heavy use of financial services to pressure foreign governments and private companies arises from the dominance of the United States and the Dollar centric financial system. The dominance is both in terms of reach, i.e. most world entities rely either directly or indirectly on this system, and in terms of absence of a viable alternative, i.e. only poor substitutes are available on the margin. For example, in a report assessing the feasibility of US sanctions on China, former Deputy Assistant U.S. Trade Representative for Investment and member of the National Security Council Emily Kilcrease stresses that: "The United States has a distinct advantage in sanctions intended to place pressure on China's economy, based on China's continued reliance on the U.S. dollar for its trade and financial operations internationally [...] Financial sanctions are among the most oft-used and powerful ways that the United States has to exert macroeconomic pressure. [...] Most of the financial sanctions leverage the privileged position of the United States in the global financial infrastructure." (Kilcrease (2023)).

Bartlett and Ophel (2021) emphasize the crucial role of the US dominance in financial services in exerting influence over foreign entities and activities that involve no direct US role. Traditionally, sanctions involve legal actions over activities that include at least one US entity or over which the US has legal jurisdiction. "In contrast, secondary sanctions target normal arms-length commercial activity that does not involve a U.S. nexus and may be legal in the jurisdictions of the transacting parties. [...] Secondary sanctions present non-U.S. targets with a choice: do business with the United States or with the sanctioned target, but not both. Given the size of the U.S. market and the role of the U.S. dollar in global trade, secondary sanctions provide Washington with tremendous leverage over foreign entities as the threat of isolation from the U.S. financial market almost always outweighs the value of commerce with sanctioned states." (Bartlett and Ophel (2021)).[15]

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

Our model helps us capture these crucial elements of US policy. First, we model financial services as a sector with strong strategic complementarities and show that a global planner, and certainly a hegemon, would want to engineer an equilibrium in which one financial system is dominant globally. From the global planner's perspective there are efficiency gains from everyone using the same system. It is a standard argument in goods trade that also adapts to financial and liquidity services. Indeed, in the presence of some fixed costs natural monopoly arguments tend to produce one dominant system. The hegemon has incentives to integrate the global economy even more than the planner, i.e. make its own system even more dominant, in order to maximize its power.

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. The hegemon has no direct control or legislative power over the foreign entity or the activity that is being affected. The hegemon uses a threat of suspension of access to US financial services to induce the foreign entity to voluntarily comply with its requests. For example, the US obtained both disclosures of information and suspension of services to certain entities in Iran and Russia by the messaging payment system SWIFT despite having no direct jurisdiction of this Belgian cooperative society. Similarly, the US put pressure on a foreign bank (HSBC) in its pursuit of sanctions against a foreign company (Huawei) and its management (Meng Wanzhou, the company's CFO and the daughter of its founder).[16]

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 technology that is less efficient but insulates the country from the hegemons' coercion. Following an earlier sanctions package applied to Russia in 2014, Russia developed a domestic messaging system called SPFS (System for Transfer of Financial Messages) that potentially helped Russia's cushion the blow of having some of its banks disconnected from SWIFT in 2023. China has been developing and growing its own messaging system CIPS (Chinese Cross-Border Interbank Payment System) in an attempt to isolate itself from potential US coercion, but also as a mean to offer an alternative to other countries that might fear US pressure.[17] India also launched its own system SFMS (Structured Financial Messaging System). For now, these alternatives are inefficient substitutes, but highlight a fragmentation response to diverging political and economic interests with the US hegemon.

In particular, we show that countries excessively shield themselves from hegemonic influence by attempting to shift towards domestic input use: placing large tariffs on the hegemon's good and subsidies on the home alternative. This moves the global equilibrium from one of excessive integration on the payments system to excessive fragmentation and reliance on home alternatives,

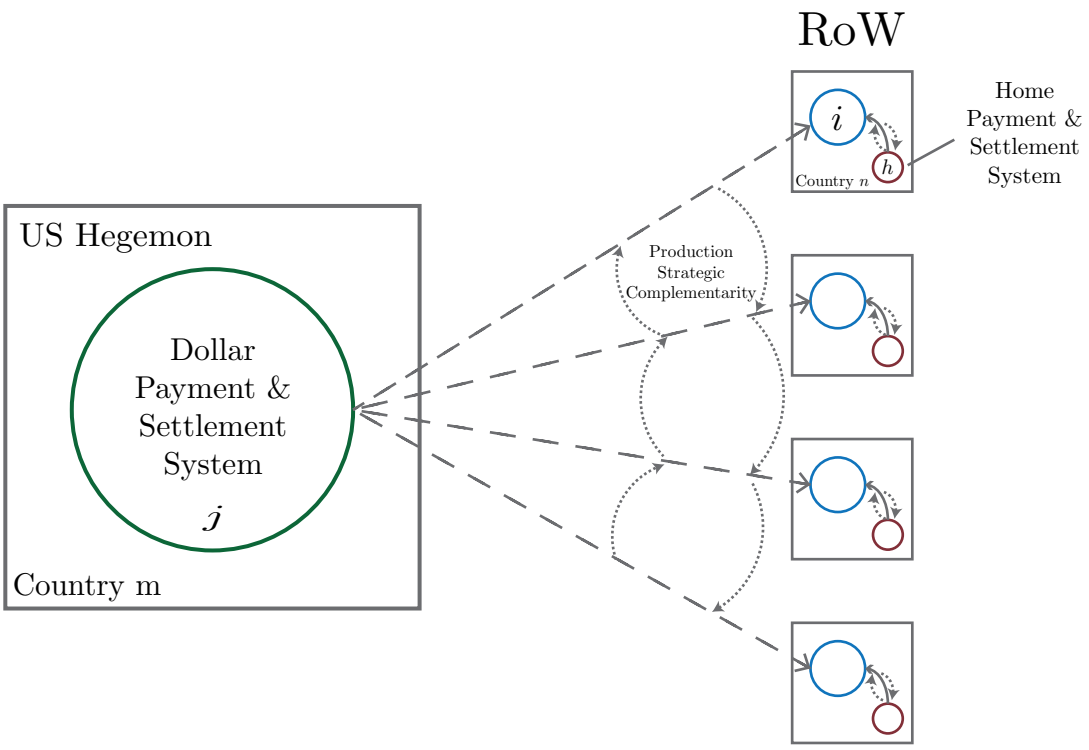
services in their own countries."

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

[17]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 it to create two-way liquidity in RMB bonds that can serve as a store of value to complement the payment system (means of payment).

unwinding the gains from international integration.

Figure 1: **US Financial Networks, Coercion, and Fragmentation**



Notes: Figure depicts the model set-up for the application on United States centric global financial networks.

4.1 Setup

We specialize the general model in the previous sections to the configuration in Figure 1. This set-up is minimalist to capture the essence of the problem. The global economy consists of the US hegemon, country m, and foreign countries $n = 1, \ldots, N$. We assume constant prices (Definition 2) to isolate focus on macroeconomic amplification through production externalities, with no terms of trade manipulation motives. The US has one sector, the financial services sector (i.e. dollar payment and settlement system) denoted by j. Sector j produces out of a single factor ℓ_m, so that production is $f_j(\ell_j) = \frac{1}{p_j}\ell_{jm}$. Each foreign country n has two sectors, i_n and h_n, and a single local factor, ℓ_n. Sector h_n ("home financial services sector") produces solely out of the local factor, $f_h(\ell_{hn}) = \frac{1}{p_h}\ell_{hn}$. These home sectors are alternatives to using the US based financial services for other industries in each country. Namely, in each country there is an identical (other than country of

origin) manufacturing sector i_n that produces out of both h_n and j with a CES production function,

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

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

Productivity $A_j(z) = \frac{1}{N} \sum_{n=1}^{N} \overline{A}_j z_{i_n j}^{\xi_j \sigma}$ of the hegemon's system and $A_{i_n h}(z) = \overline{A}_h z_{i_n h}^{\xi_h \sigma}$ of the home alternative are both non-decreasing in their arguments. This captures a strategic complementarity in use of either input among firms within sector i_n. There is also a strategic complementarity across sectors i_n in their use of the international good j.[18] The parameters $\xi_j \geq 0$ and $\xi_h \geq 0$ govern the economies of scale, with higher values generating stronger spillovers. We restrict $(1+\xi_j)\beta < 1$ and $(1+\xi_h)\beta < 1$ for concavity in the aggregate production function. We restrict $(1+\xi_j)\left(1-\frac{\beta}{\sigma}\right) \leq 1$ so cross-country use of j are complements in production.[19] Throughout this application, we simplify analysis by abstracting away from the hegemon's non-negativity constraint on transfers.[20] For example, for given domestic policies, the non-negativity constraint will tend not to bind when the hegemon's good is sufficiently valuable.

4.2 Global Planner and Noncooperative Benchmarks

We begin by specializing the benchmarks of the global planner's efficient allocation and the noncooperative outcome without a hegemon (Section 3.3) to this setting. We then compare these benchmarks with what the Hegemon implements in the presence or absence of anti-coercion policy from the rest of the countries.

Global Planner. We specialize the results of Proposition 4 in the general setup to this problem. Because there are no externalities that fall directly on consumers, $\frac{\partial u_n}{\partial z_{i_n j}} = \frac{\partial u_n}{\partial z_{i_n h}} = 0$. An increase in use of input j by any individual country spills over to the productivity of every country. In particular,

[18] 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 are of course meaningfully distinct. Each of them could be separately modelled with full foundations. Instead, we capture two essential and common features: these services are an important input into production (payments to acquire inputs and collect revenues, transfers to allocate production capital), and they feature strategic complementarities across firms and sectors. Second, we abstract from multiple layers in the network and assume the services are directly provided by the US entities. Our framework can clearly handle indirect threats via foreign entities that themselves are connected to the US (e.g. SWIFT).

[19] 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.

[20] Formally, we relax the non-negativity constraint for the section. 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.

the global spillover comes exclusively from the productivity spillover, related to curvature ξ_j. The following corollary of Proposition 4 shows that the global planner's tax formulas are simple subsidies on use of both the hegemon's system and the home alternative.

Corollary 2 *The global planner's optimal wedges are*

$$\tau^x_{n,i_n j} = -\frac{\xi_j}{1+\xi_j} p_j \tag{13}$$

$$\tau^x_{n,i_n h} = -\frac{\xi_h}{1+\xi_h} p_h \tag{14}$$

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

Figure 2 illustrates the planner's solution. 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 given our assumption of constant prices, and the marginal cost curve is increasing in y_i given our decreasing returns to scale, with

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

when firm i faces wedges τ_{ih}, τ_{ij}. Firm profits, which here coincide with welfare, are the area between the $MR(y_i)$ and $MC(y_i)$ curves. The planner solution in Corollary 2 maximizes this area by making the firms face lower prices (negative wedges) that stimulate usage of inputs 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 wedges via each firm choice of inputs. We denote $MC^{GP}(y_i)$ the marginal cost curve of firms in sector i in the resulting equilibrium.

Noncooperative Optimum. We can also evaluate the noncooperative outcome without a hegemon, in which each country sets its own policies. We specialize the general result of Proposition

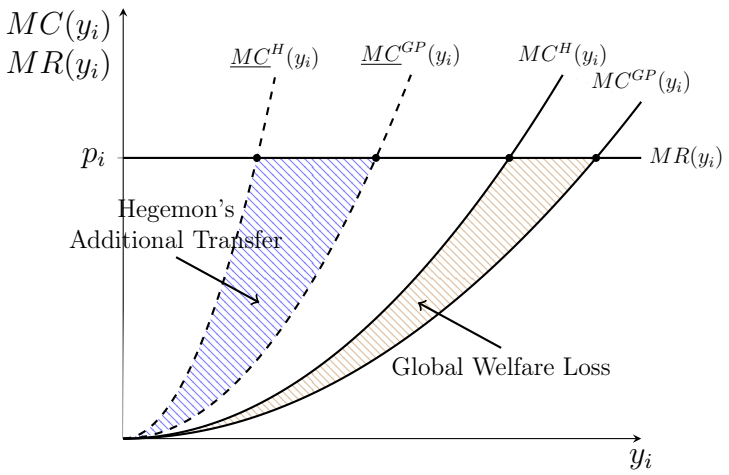


Figure 2: Global Planner and Hegemon Equilibria

5 to this application. For simplicity, we take $N \to \infty$.[21]

Corollary 3 *Let $N \to \infty$. Absent a hegemon, the optimal input wedges of country n are*

$$\tau^x_{n,i_n j} = 0$$

$$\tau^x_{n,i_n h} = -\frac{\xi_h}{1+\xi_h} p_h$$

Country n places the same subsidy on the home alternative as did the global planner, reflecting that each country n fully internalizes the strategic complementary in its use of the home alternative because its benefits accrue entirely to the domestic economy. On the other hand, although country n benefits from the use of the hegemon's system, it does not internalize the global strategic complementarity in adoption and places no tax or subsidy on use of j, that is $\tau^x_{n,i_n j} = 0$. The noncooperative outcome, therefore, features efficient subsidies of the home alternative, but no subsidies of the global alternative. As a result, the noncooperative outcome features too much use of the home alternative and too little of the hegemon's system.

4.3 Hegemon's Optimal Contract under Anti-Coercion

Having characterized the global optimum and the noncooperative outcome, we now specialize the hegemon's optimal contract of Proposition 1 to this application, taking as given the domestic policies τ_n adopted by all countries.

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

Specializing the hegemon's tax formula from Proposition 1, all terms except for the participation constraint term related to z-externalities are zero in this application. Since the punishment for rejecting the contract is exclusion from using the hegemon's good j, the profits at the outside option of firm i_n (excluding remissions) are

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

Importantly, $\Pi^o_{i_n}$ is a function of $z_{i_n h}$, but is not a function of A_j. Since the marginal value of wealth is also 1 and since $\eta_{i_n} = 0$ (given the hegemon extracts positive side payments), the hegemon's tax formulas reduce to

$$\tau^x_{m,ij} = -\sum_{n=1}^{N} \frac{\partial \Pi_{i_n}}{\partial z_{ij}}$$

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

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 of the global planner on use of good j, which is not used by firms at their outside option. By contrast, the hegemon internalizes externalities on 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 4 *When foreign countries' domestic policies are symmetric, the hegemon's optimal wedges are*

$$\tau^x_{m,i_n j} = -\frac{\xi_j}{1+\xi_j} \left(p_j + \tau^x_{n,i_n j} \right) \tag{15}$$

$$\tau^x_{m,i_n h} = \frac{\xi_h}{1+\xi_h} \left(\frac{x^o_{i_n h}}{x^*_{i_n h}} - 1 \right) \left(p_h + \tau^x_{n,i_n h} \right) \tag{16}$$

Comparing the hegemon's optimal wedges to those of the global planner, two key properties emerge. First, the hegemon sets the same wedge on US financial services j according to the same formula as the global planner, up to accounting for the effects of taxes imposed by foreign countries on good j. In particular if other countries are not pursuing anticoercion policies, that is $\tau^x_{n,i_n j} = 0$, then the hegemon's subsidy is exactly that of the global planner. Intuitively, the hegemon, like the global planner, internalizes the positive spillover achieved by increasing firms' use of j. Whereas the global planner values this increase in profits directly, the hegemon also values the profits of foreign firms because higher profits allow the hegemon to extract a larger transfer. This aligns the hegemon's incentives with the global planner's in terms of choice of the wedge on j. On the other hand, if countries were on average imposing taxes on the hegemon's good, the hegemon would perceive a

higher cost to these firms of employing more of the hegemon's input, analogous to a higher price p_j. This would result in a higher unit subsidy, but the same proportional subsidy to the total effective price $p_j + \tau^x_{n,i_n j}$. Intuitively, a higher effective price means that global use of the hegemon's input is low, and the marginal productivity benefit of increasing usage is higher. This motivates larger subsidies from the hegemon to increase usage. On net, however, the hegemon's subsidy rises at less than a one-for-one rate with increases in anti-coercion taxes on j.

In contrast, the hegemon imposes a smaller subsidy or even a tax on use of home financial services h. On the one hand, higher on-path firm profits lead the hegemon to want to subsidize h, exactly as it did for j, to increase the size of the transfer payment it can extract. On the other hand, increasing productivity A_h of home financial services also increases the outside option of a firm that opted to reject the hegemon's contract and rely on home financial services. The hegemon therefore trades off the on-path profit gains against not wanting to make rejecting the contract too appealing. As a result, the hegemon reduces the wedge on home financial service usage by i relative to that chosen by the global planner. In contrast, there is no similar incentive to manipulate the outside option by changing A_j (US financial services productivity) precisely because the threatened punishment of the outside option is being cut off from using j entirely.

Returning to Figure 2, the marginal cost curve faced by a firm that rejects the hegemon's contract is equivalent to taking $\tau_{ij} \to \infty$ for that specific firm (but not other firms in the sector), yielding

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

Suppose the hegemon was implementing the same wedges as the global planner. Then, a firm that rejects the contract would face the marginal cost curve $\underline{MC}^{GP}(y_i)$, and the hegemon could extract as a transfer the difference in profits between the inside option and the outside option for firm i. This is the area (below p_i) between the curves $\underline{MC}^{GP}(y_i)$ and $MC^{GP}(y_i)$. This is, however, not the best that the hegemon can do. By implementing wedges that shift the firms that accept the contract to using more of the hegemon's payment system and less of the domestic alternative, the hegemon can further penalize firms that reject its contract. Visually, the inside option marginal cost curve is now $MC^H(y_i)$ that is to the left of $MC^{GP}(y_i)$, 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 firm's outside option, reflected in a shifting of the outside option marginal cost curve to $\underline{MC}^H(y_i)$. This shifting of the outside option increase the hegemon's transfer, reflected in the blue shaded area. The hegemon is getting the rest of the world "addicted" to its financial services to increase the power it can achieve by threatening withdrawals, increasing use of its system and decreasing use of alternatives. We make this intuition on changes in usage formal in the next proposition.

Excessive International Integration. Corollary 4 derives the hegemon's optimal wedges and compares them to those of the global planner. To shed light on how the hegemon operates and the potential motivations for anticoercion policies, we compare the *allocations* under the hegemon's solution in absence of anticoercion policies to the allocations of the global planner. In particular, we show that the hegemon increases use of its financial services and decreases use of home financial services relative to the global planner's optimum.

Proposition 7 *In absence of anticoercion policies ($\tau_n = 0$), the hegemon's optimum has weakly higher x_{in_j} and weakly lower x_{in_h} than the global planner's optimum.*

Proposition 7 maps the difference in the hegemon's chosen wedges into a different set 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 firms towards greater use of hegemon's financial services. The hegemon, therefore, generically promotes "excessive international integration" that loads too heavily on use of its financial services. By encouraging firms to over-use the hegemon's services and under-use the home alternative, the hegemon makes rejecting its own contract more costly and increases the power it has over each firm, enabling it to collect larger transfers.

Does the Hegemon Add Value? An important question for the anti-coercion perspective is whether the hegemon actually increases foreign firms on-path profits. There are two forces at play. On the one hand, the hegemon efficiently subsidizes purchases of input j in order to maximize the on-path profits of firms and hence increase the size of the transfer that it can extract. This pushes the hegemon's solution towards the global planner's solution. However, while enacting the global planner's wedge on h maximizes firm on-path profits, by the Envelope Theorem the hegemon always wants to decrease use of h by at least some relative to the planner's solution in order to reduce the outside option of firms that reject the contract. This reduces reduces the on-path profits of foreign firms, generating an efficiency loss. We can shed light on whether the hegemon adds value by looking at two limiting cases in which only one of the two goods has a strategic complementarity.

At the one extreme, if there is no strategic complementarity in the usage of the home alternative h (i.e., $\xi_h = 0$), then the outside option is fixed from the hegemon's perspective. The hegemon's only incentive is to maximize on-path profits of foreign firms, and Corollary 4 shows that the hegemon implements the global planner's efficient allocation (absent anti-coercion). However, even though the hegemon implements the globally efficient allocation, it charges as large a transfer as possible in the process. We investigate the welfare consequences in Section 4.5

At the other extreme, if there is no strategic complementarity in the usage of input j, the hegemon's maximization of slack can actually lead to efficiency losses. In particular, if $x^o_{ih} > x_{ih}$, meaning that firms would use more of the home financial services if they rejected the contract, then

the hegemon introduces a tax on use of h and therefore is purely value-destroying. Intuitively, the hegemon can be incentivized to reduce usage of the home alternative on path in order to make the outside option less attractive. Indeed, it is straight-forward to show that in absence of anticoercion policies and at a low enough elasticity of the external economies of scale, the hegemon indeed imposes a positive tax on the home alternative, and so the hegemon actually lowers value in equilibrium even while promoting integration.[22]

4.4 Positive Effects of Anti-Coercion on Fragmentation

Before analyzing optimal anticoercion, we start by studying 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 domestic policy changes by country n.

Proposition 8 *Suppose that all countries apart from n have adopted symmetric domestic policies. Then accounting for the hegemon's endogenous response:*

1. *An increase in the country n tax on the hegemon's good j lowers every country's use of j and raises every country's use of h, that is:*

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

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

$$\frac{\partial z_{i_r j}}{\partial (-\tau^x_{n,i_n h})} \leq 0, \quad \frac{\partial z_{i_r h}}{\partial (-\tau^x_{n,i_n h})} \geq 0 \quad \forall r = 1, \ldots, N$$

Proposition 8 highlights the equilibrium effects of a single country changing its domestic policy, holding fixed the domestic policies of all other countries but accounting for reoptimization by the hegemon of its contract. Proposition 8 shows that an increase in country n's tax on the hegemon's input j leads country n's firms to shift away from the hegemon's good and towards the home alternative. However, the shift is not isolated to country n, but propagates to every other country. That is, the entire world rebalances away from the hegemon's input and towards the home alternative. Intuitively, the increase in tax by country n makes it more costly for the hegemon to demand that

[22] The flip-side of this is that if $x^*_{ih} \geq x^o_{ih}$, then the hegemon imposes a subsidy and can increase value. We focus expositionally on the case of value destruction since countries would already efficiently subsidize their home alternative in the noncooperative equilibirum without a hegemon.

country n use its system, scaling back how much the hegemon optimally demands use of j and consequently generating a rebalancing in country n towards the home alterantive. Due to the strategic complementarity, the hegemon's input j becomes less productive globally, and so also becomes less attractive to other countries. This increases the cost to the hegemon of asking other countries to use its system as opposed to their home alternative, leading to a rebalancing of other countries away from the hegemon's system and towards their own home alternatives. A pursuit of anti-coercion by a single country thus generates an increase in global fragmentation, shifting not only its own firms but also all other countries away from the hegemon's system and towards home alternatives. The same logic also applies to subsidies of the home alternative.

4.5 Optimal Anticoercion, Fragmentation, and Welfare

We next study optimal domestic policies adopted by country n, taking as given the symmetric domestic policies of (non-hegemonic) countries $-n$. We also investigate the welfare consequences of hegemonic power and anticoercion.

The following result is a counterpart of Proposition 3 in the general theory. It shows that optimal anti-coercion policies result in global fragmentation.

Proposition 9 *Suppose all other countries have adopted symmetric domestic policies. An optimal domestic policy of country n is to set $\tau^x_{n,i_nj} \to \infty$ and $\tau_{n,i_nh} = -\frac{\xi_h}{1+\xi_h} p_h$. Therefore, country n efficiently subsidizes its home alternative and also prevents its firms from using the hegemon's system.*

Proposition 9 reveals that the optimal policy of country n results in international fragmentation, whereby country n prohibits use of the hegemon's system entirely ($\tau^x_{n,i_nj} \to \infty$) and relies exclusively on the home alternative. Intuitively, the hegemon would extract all gains from international integration ex post, leaving country n in the same position as if relied exclusively on the home alternative. This means that any use $x_{i_nj} > 0$ of the hegemon's system crowds out use of the home alternative, lowering its productivity and so lowering the outside option. As a result, country n finds it optimal to prohibit use of the hegemon's system entirely, resulting in full fragmentation from the global system. Once country n is relying exclusively on its home alternative, than its subsidy $\tau_{n,i_nh} = -\frac{\xi_h}{1+\xi_h} p_h$ is of course set efficiently.

The international fragmentation induced by anticoercion policies (Propositions 8 and 9) contrasts starkly with the excessive international integration achieved by the hegemon in absence of anticoercion (Proposition 7). Relative to the global planner, the hegemon perceived excess value from use of its system relative to the home alternative because this excess use increased the hegemon's power and allowed for greater extraction of transfers. At the same time, the policy of the hegemon removes the gains from integration from the perspective of each country n, since those

gains are being extracted by the hegemon. Country n thus perceives it as efficient to maximize the value achieved from the home alternative, which involves efficiently subsidizing it but also preventing usage from being diverted to the hegemon's system, from which country n (in equilibrium) obtains no value.

Welfare Consequences of Hegemonic Power and Anti-Coercion. Finally, we ask how the presence of hegemonic power and anticoercion policies affect welfare, both from the perspective of aggregate surplus and the welfare of individual countries. In doing so, we compare the welfare outcomes under the noncooperative outcome, the equilibrium with a hegemon and no anticoercion policies, and the equilibrium with a hegemon and anticoercion policies. The following result summarizes the welfare consequences as $N \to \infty$.

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

1. *The noncooperative outcome without a hegemon* Pareto *dominates the outcome with optimal anticercion and a hegemon.*
2. *Let $\xi_h = 0$. Then, the hegemon's outcome without anticoercion implements the global planner's efficient allocation and so increases total surplus. However, every country $n \neq m$ is worse off than in the noncooperative outcome without a hegemon.*

The first part of Proposition 10 shows that the noncooperative outcome without a hegemon always *Pareto* dominates the anticoercion equilibrium with a hegemon. That is, the international fragmentation induced as countries attempt to shield themselves from hegemonic power is inefficient. In the noncooperative outcome without a hegemon, country n efficiently subsidized its home alternative, $\tau^x_{n,i_n h} = -\frac{\xi_h}{1+\xi_h}$, but put neither a tax nor a subsidy on the hegemon's system. Thus although the noncooperative outcome features under-utilization of the hegemon's system relative to the planner's solution, it still features a less distorted use compared with the fragmentation outcome, which features a complete prohibition on the hegemon's system. As a result, a world with a global hegemon in which anticoercion policies seek to mitigate that hegemon's influence, in fact yields a worse outcome than a world without a global hegemon.

The second part of Proposition 10 takes the limiting case of $\xi_h = 0$, in which the hegemon in fact implements the global planner's optimum. Thus total surplus necessarily increases relative to the hegemon's solution. Nevertheless, even though the globally efficient allocation is attained, every country apart from the hegemon is worse off than in the noncooperative equilibrium without a hegemon. Intuitively, country welfare is the determined by use of the home alternative in isolation, which must necessarily leave these countries worse off than if they had access to both the home system and the hegemon's system (without a tax or subsidy). As a result, the hegemon's extraction of not only the increase in total surplus but also the gap relative to the outside option leaves other

countries worse off. This benchmark helps to understand why countries pursue the anti-coercion policies that then result in inefficient fragmentation.

5 Using the Model as an Empirical Guide

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

5.1 The Financial System and the Sources of Geoeconomic Power

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

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

where σ_J is the elasticity of substitution of goods produced by different countries within a given industry J, ρ is the elasticity of substitution across industries, and β measures decreasing returns to scale. Here, we consider a tractable case in which the outer nest is Cobb-Douglas ($\rho = 1$). Following the derivation in Clayton et al. (2023), we show that the loss of value to firm i from losing access to country n's industry J can be written as:[23]

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

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

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

hegemon's goods as (ignoring the returns to scale term)[24]

$$\tilde{\nu}_n \equiv \sum_{i \in \mathcal{I}_n} \sum_{J \in \mathcal{J}} \left(\log \nu_i(\mathcal{J}_i) - \log \nu_i(\mathcal{J}_i \backslash \{(Jm)\}) \right) \tag{18}$$

This captures how much of an economic loss country n experiences if it loses access to the hegemon's goods.[25] Because the size of this loss determines the value to country n of retaining access to the hegemon's inputs, it determines the cost to country n of actions (wedges, transfers, or political concessions) that the hegemon can ask for before the entities in that country prefer to decline the contract. This is a natural measure of the hegemon's power over a country n. This measure of the power that a hegemon has over countries around the world is motivated by Hirschman (1945), and our calculation is similar to Hausmann et al. (2024) who measure the cost that the United States and Europe can impose on Russia via export controls in the Baqaee and Farhi (2022) framework. More generally, our measure parallels the sufficient statistics for welfare gains from international trade in Arkolakis et al. (2012). Here, we focus on two potential hegemons, the United States and China, and we assume that only the hegemon can cut off exports. For every country n, we measure the level of power that the hegemon (United States or China) has over the country in equation (18). In our baseline empirical implementation, we start by considering punishments of cutting off all inputs from firms based in the hegemon country and abstract from threats using other foreign firms. Including punishments that involve firms in third party countries would add to measured power and would be a valuable next step.

To implement our measure, we use trade data from the International Trade and Production Database for Estimation (ITPD-E) Version 2.0 from Borchert et al. (2022). This has the advantage of containing domestic production data, improving the calculation of ω, as well as including data on service trade. In this case, we match each elasticity at the HS06 level to an ISIC rev. 3 industry code, and then match ITPD-E industries to the ISIC level. We use elasticities of substitution based on tariff changes from Fontagné et al. (2022). These are estimated based on tariff rates at the HS06 level. These cover the universe of manufacturing exports, but do not include estimates for some primary products or services. We assume that the elasticity of substituion within ITPD-E industry is the mean elasticity of substitution of the HS06/ISIC matched to that industry.

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

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

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

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

To include trade in financial services in our measure of power, we begin by following the calibration in Pellegrino et al. (2021). Pellegrino et al. (2021) calibrates the elasticity of substitution between different countries' assets at 1.3 based on the demand system estimates of Koijen and Yogo (2020).[26] Our measure of financial services includes both "Financial Services" and "Insurance and Pensions" from the ITPD-E data. However, it is important to note that these estimated elasticities of substitution across financial assets of various countries were not designed to measure the elasticity of substitution of financial service provision across countries.

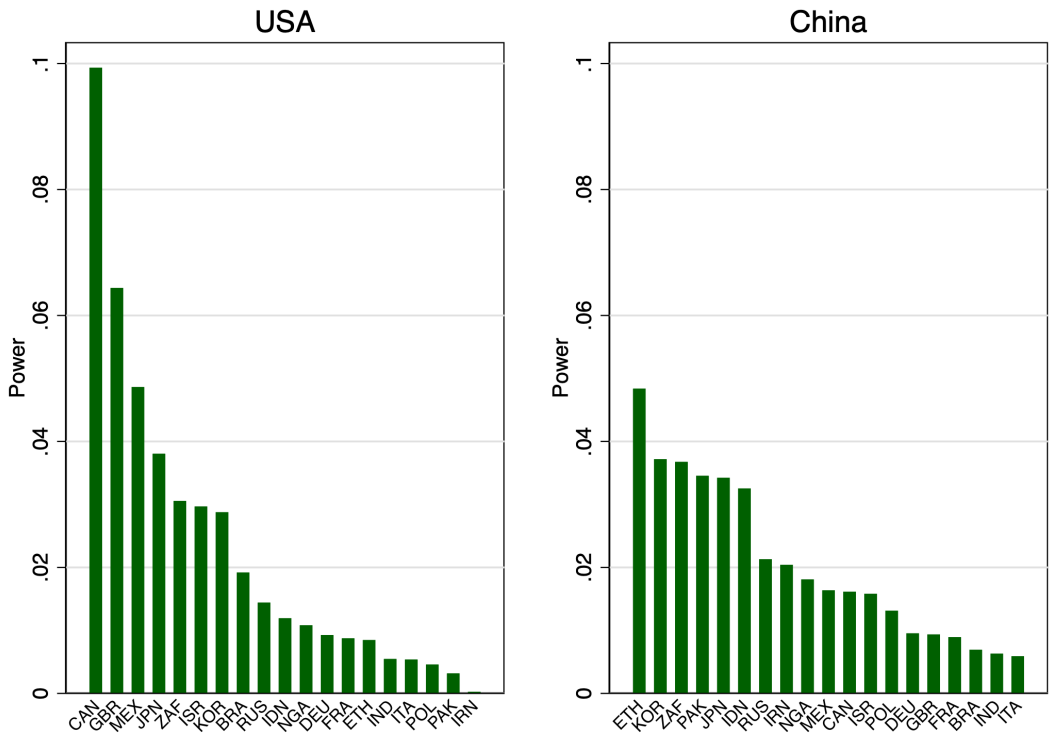
Empirical Measure In Figure 3, we plot our measure of American and Chinese power over countries around the world for 2018. As expected, the United States and China have more power over countries relatively close to them, with the US displaying a large amount of power over Canada and Mexico and China possessing a large amount of power over South Korea.

In Figure 4, we construct an aggregate measure of US and Chinese power, weighting countries by their economic size. Importantly, we split total power over the rest of the world (excluding the power the US and China have over each other) into the part coming from manufacturing trade and that coming from finance.[27] If we were to only measure American and Chinese power using the goods trade data and the corresponding elasticities, then it would appear that China has far

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

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

Figure 3: **American and Chinese Geoeconomic Power, 2018**

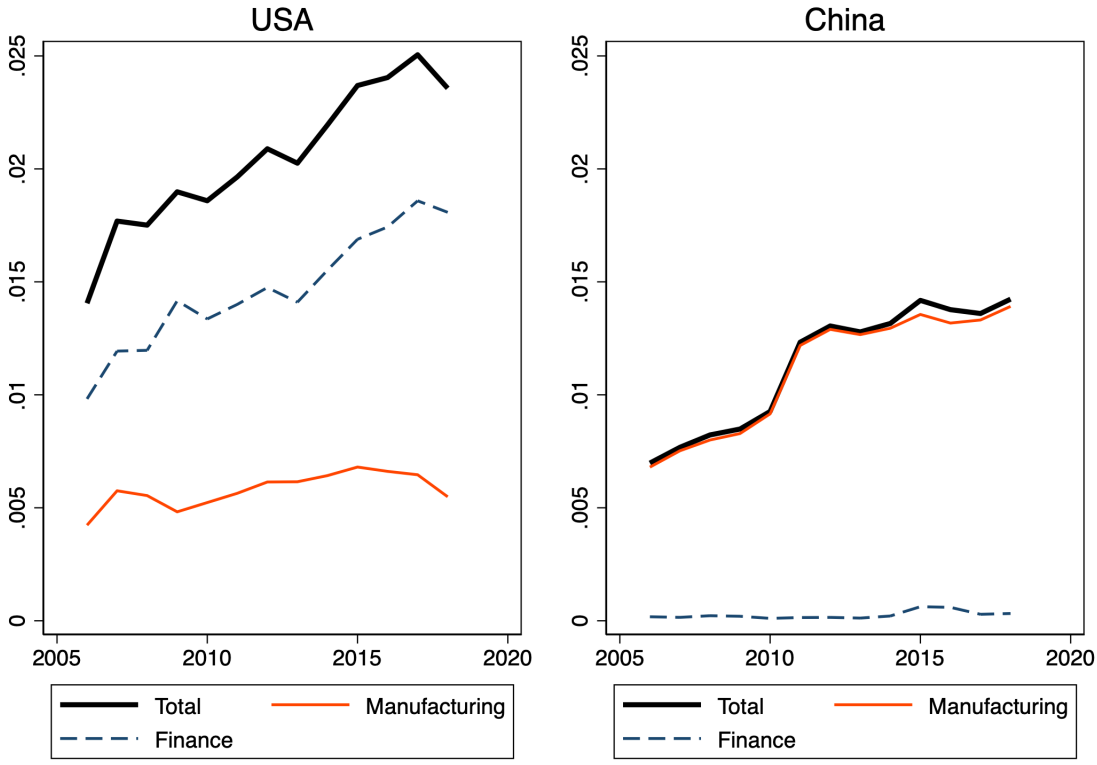


Notes: The figure plots estimates of the power as in equation (18). Trade and production data are from ITPD-E and elasticities are from Fontagné et al. (2022).

surpassed the United States in terms of geoeconomic power. However, we see that China has very limited financial power, whereas finance accounts for roughly 75% of American power in recent years. While this figure was constructed to be consistent with the Balance of Payments and so Mainland China and Hong Kong are treated as distinct entities, if we were to consider Hong Kong's exports of financial services as part of China's power, then China would have significantly more measured financial power. However, the conclusion that finance is a disproportionately important source of American power relative to manufacturing in China would not change.

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

Figure 4: US and Chinese Power: Manufacturing and Finance



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

management fees, even if they would be far more costly to lose access to.

5.2 Gravity and Geoeconomic Alignment

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

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

industry J in country o. We assume that production by firm i takes a nested form,

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

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

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

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

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

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

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

5.2.1 Geopolitical Utility Spillovers in the Non-cooperative Equilibrium

In order to take the model to the data, we need to characterize the wedges imposed by countries around the world. We begin with the non-cooperative equilibrium without a hegemon. We consider a simple variant in which there are utility spillovers from bilateral trades. To obtain concrete tax formulas, we assume constant prices (Definition 2). The utility spillover to country n is given by

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

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

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

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

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

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

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

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

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

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

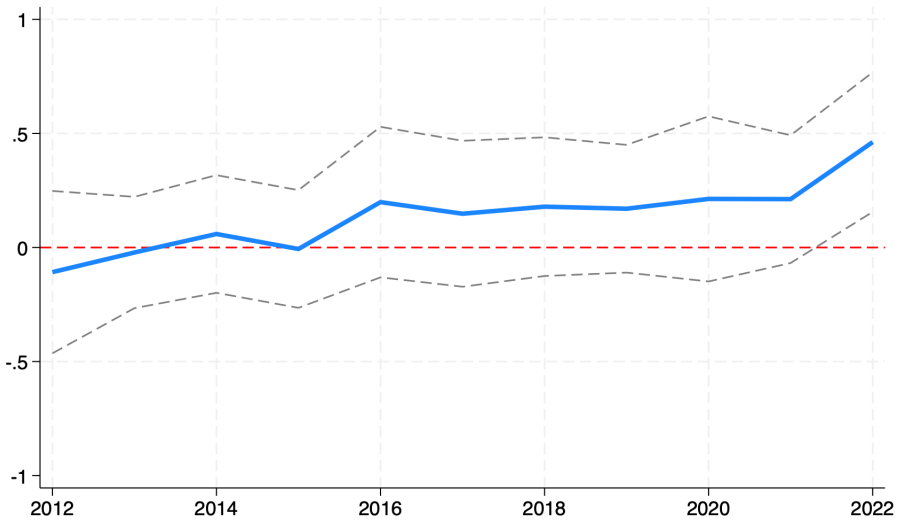
We measure bilateral trade flows at the industry level using the BACI trade dataset, based on UN Comtrade data covering 2012-2022 based on the HS12 industry code. We then aggregate the industry data to the ISIC3 level for our regression specification. The advantage of the BACI data is that it lets us take the analysis through 2022 as opposed to the ITPD data that ends in 2019. Given our emphasis on fragmentation, and exploring its rise in recent years, this is an important benefit of BACI. There are two disadvantage 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).[28] For the gravity varaiables $\alpha_{iJn'}$, we use the CEPII Gravity database (Conte et al. (2022)) and include the log of geographic distance and a dummy for contiguity.

In Figure 5, 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

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

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. However, one natural question is whether this could be driven by changes in geopolitical alignment, $\Delta\zeta_{nn't}$. To address this question, in Appendix Figure A.2, we re-estimate our regressions using $\overline{\zeta_{nn'}}$, the average bilateral UN voting agreement between 2012 and 2022. We find that the pattern is essentially unchanged, indicating that the pattern is not driven by a geopolitical realignment, but rather changes in the weight put on geopolitics, θ_t. Table 21 reports the full regression results for 2013, 2016, 2019, and 2022.[29]

Figure 5: Time Variation in Geopolitical Weight, θ_t



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

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

[29] While a similar increase in the 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 1: Trade and Political Affinity, Select Years

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

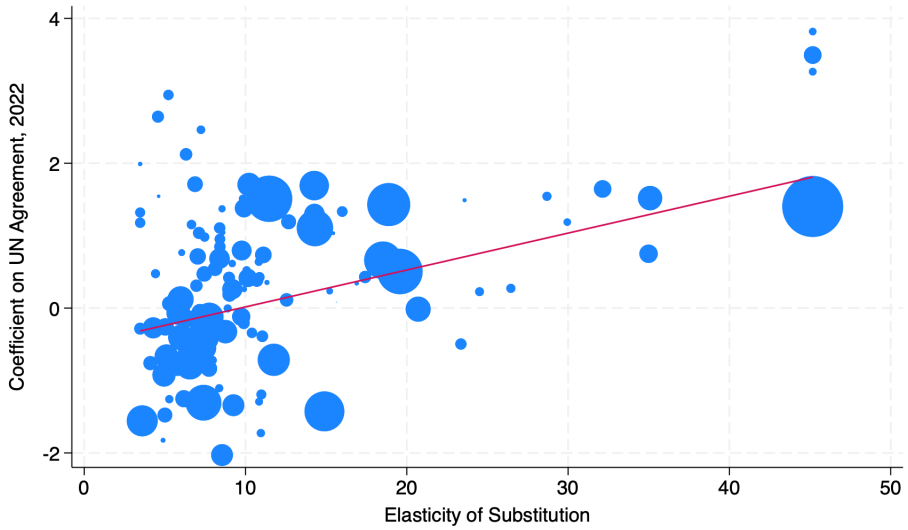
Notes: The table reports regression results from equation 21, estimating using the package of Correia et al. (2020).

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

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

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

Figure 6: Geopolitical Closeness and the Elasticity of Substitution, 2022



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

Figure 6 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 6 visually confirms the strong positive relationship implied by the model, Table 2 explores the relationship more formally. In particular, it runs a regression of the form $\theta_J = \alpha + \beta\sigma_J + \epsilon_J$. Column 1 runs this regression on the raw data, column 2 weights the observations 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.[30] Indeed, this simple uni-variate regression can explain nearly 30% of the variation in industry heterogeneity in the importance of geopolitics.

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

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

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

5.2.2 Gravity and Macro-Power

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

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

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

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

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

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

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

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

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

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

6 Conclusion

Geoeconomic tensions have been on the rise given political shifts in the US, the rise of China as a great economic power, and changes in technology. These tensions have the potential to fragment the world trade and financial system, unwinding gains from international integration. A number of countries are introducing mixes of industrial, trade, and financial policy to insulate their economies from unwanted foreign influence. Collectively these policies come under the umbrella of anti-coercion tools. We provide a simple model to jointly analyze economic coercion by a hegemon and anti-coercion policies by the rest of the world. We show that precisely those forces, like economies of scale,

that are traditional rationales for global integration and specialization can be used by a hegemon to increase its coercive power. The rest of the world countries react by implementing anti-coercion policies that shift their domestic firms away from the hegemon global inputs into an inefficient home alternative. We show that uncoordinated anti-coercion policy results in inefficient fragmentation as each country over insulates its economy. We study the financial services industry, e.g. global payments and settlement systems, as an industry with strong strategic complementarities at the global level. The US uses its dominance in these financial services as a tool of coercion. China and Russia have resorted to using inefficient home alternatives to insulate their economies from possible US pressure.

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Online Appendix for
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A.1 Proofs

A.1.1 Proof of Lemma 1

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

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

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

A.1.2 Proof of Lemma 2

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

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

Given Assumption 1, we can define the expenditures of consumer n as

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

and, therefore, aggregate consumption is given by

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

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

A.1.3 Proof of Proposition 1

The hegemon's problem is to choose τ_m to maximize

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

subject to the non-negativity constraint on transfers,

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

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

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

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

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

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

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

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

Direct effect. First, we have the direct effect,

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

Thus substituting in the firm's FOCs, we have

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

Indirect Effect of z. We have

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

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

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

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

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

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

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

Indirect Effect of P. We have

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

As above, we have

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

Next, we can write

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

and similarly

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

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

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

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

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

We can then regroup terms as:

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

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 $ED=(ED_1,\ldots,ED_{|\mathcal{I}|},ED^\ell_1,\ldots,ED_{|\mathcal{F}|})^T$, 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 $ED^\ell_f=\sum_{i\in\mathcal{I}_n}\ell^*_{if}-\bar{\ell}_f$ 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

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

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

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

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

A.1.4 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,

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

which yields our first equation,

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

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

Next, we define the vector of excess demand ED as the stacked system of excess demand in

goods and factor markets, where excess demand for good i is

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

and excess demand for factor f is

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

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

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

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

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

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

A.1.5 Proof of Proposition 3

Country n solves

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

To reduce cumbersome notation, observe that without loss of generality we can define $V_i(\mathcal{J}_i) = V_i^o(\underline{\mathcal{J}}_i)$ for $i \in \mathcal{I}_n \setminus \mathcal{C}_m$, 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

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

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

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

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

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

Finally, for a price perturbation we have

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

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

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

Re-stacking,

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

Under this stacking convention, we can therefore write

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

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

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

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

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

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

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

Rearranging, we obtain

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

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

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

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

and similarly, we have

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

Therefore, we can write

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

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

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

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

and so write

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

Thus substituting into the tax formula,

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

A.1.6 Proof of Corollary 1

Given constant prices, the hegemon's optimal contract is to set $\tau_{m,i} = 0$ for $i \in \mathcal{C}_m$ and to set $T_i = V_i(0, \mathcal{J}_i) - V_i(0, \underline{\mathcal{J}}_i)$. Therefore, we can write the country n government's objective as

$$\begin{aligned} \mathcal{U}_{n_0} = w_{n_0} &= \sum_{i \in \mathcal{I}_{n_0} \cap \mathcal{C}_m} V_i(\underline{\mathcal{J}}_i) + \sum_{i \in \mathcal{I}_{n_0} \setminus \mathcal{C}_m} V_i(\mathcal{J}_i) + \sum_{f \in \mathcal{F}_m} p_f^\ell \overline{\ell}_f. \\ &= \sum_{i \in \mathcal{I}_{n_0} \cap \mathcal{C}_m} \Pi_i(x_i, \ell_i, \underline{\mathcal{J}}_i) + \sum_{i \in \mathcal{I}_{n_0} \setminus \mathcal{C}_m} \Pi_i(x_i, \ell_i, \mathcal{J}_i) + \sum_{f \in \mathcal{F}_m} p_f^\ell \overline{\ell}_f. \end{aligned}$$

Therefore, $\tau_n = 0$ is an optimal policy.

A.1.7 Proof of Proposition 4

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

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

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

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

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

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

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

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

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

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

and therefore,

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

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

A.1.8 Proof of Proposition 5

Absent a hegemon, the objective of country n is

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

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

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

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

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

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

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

Following the proofs of Propositions 1 and 3, we have

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

and

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

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

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

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

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

Factor wedges are derived analogously,

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

A.1.9 Proof of Proposition 6

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

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

The corresponding FOC for x_{ij} is

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

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

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

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

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

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.1.10 Proof of Corollary 2

Specializing Proposition 4 to the application, we have

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

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

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

So that substituting in,

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

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

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

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

A.1.11 Proof of Corollary 3

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.1.12 Proof of Corollary 4

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

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

The firm's FOC is for j is

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

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

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

which yields the result,

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

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

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

By Envelope Theorem,

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

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

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

we therefore have

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

Thus substituting in,

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

Finally, rearranging gives

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

which completes the proof.

A.1.13 Proof of Proposition 7

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

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

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

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

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.1.14 Proof of Proposition 8

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

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

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 note these by $(x_{ij}, x_{ih}, X_{ij}, X_{ih})$.

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

Supermodularity. We first show that the objective is supermodular in $(x_{ij}, -x_{ih}, X_{ij}, -X_{ih})$. We do so by separately showing that both components of the objective are supermodular. Note that cross partials in Π_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

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

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

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

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

Finally, we have

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

so that

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

This is positive if

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

which simplifies to

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

Finally, we can bound

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

so that the sufficient condition is

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

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

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

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

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

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

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

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

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

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

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

so that we have

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

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

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

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

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

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

A.1.15 Proof of Proposition 9

Consider the objective of the country n government, which solves

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

where we have

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

where the optimal policy is

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

Substituting in the optimal policy, we have

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

Therefore, we have

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

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

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

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 8, we therefore have

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

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

Given $\tau_{n,i_n j} \to \infty$ (i.e., a ban on j), the hegemon optimally sets $x_{ij} = 0$, and so can only set $\tau^x_{m,i_n h} = T_{i_n} = 0$ without its contract being rejected. 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.1.16 Proof of Proposition 10

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

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

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

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

which again follows from the Inada condition.

A.1.17 Proof of Proposition 11

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

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

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

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

Substituting into the constraint,

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

Thus substituting back into expenditures, we have

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

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

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

The outer problem is thus given by

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

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

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

Taking logs, we have

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

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

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

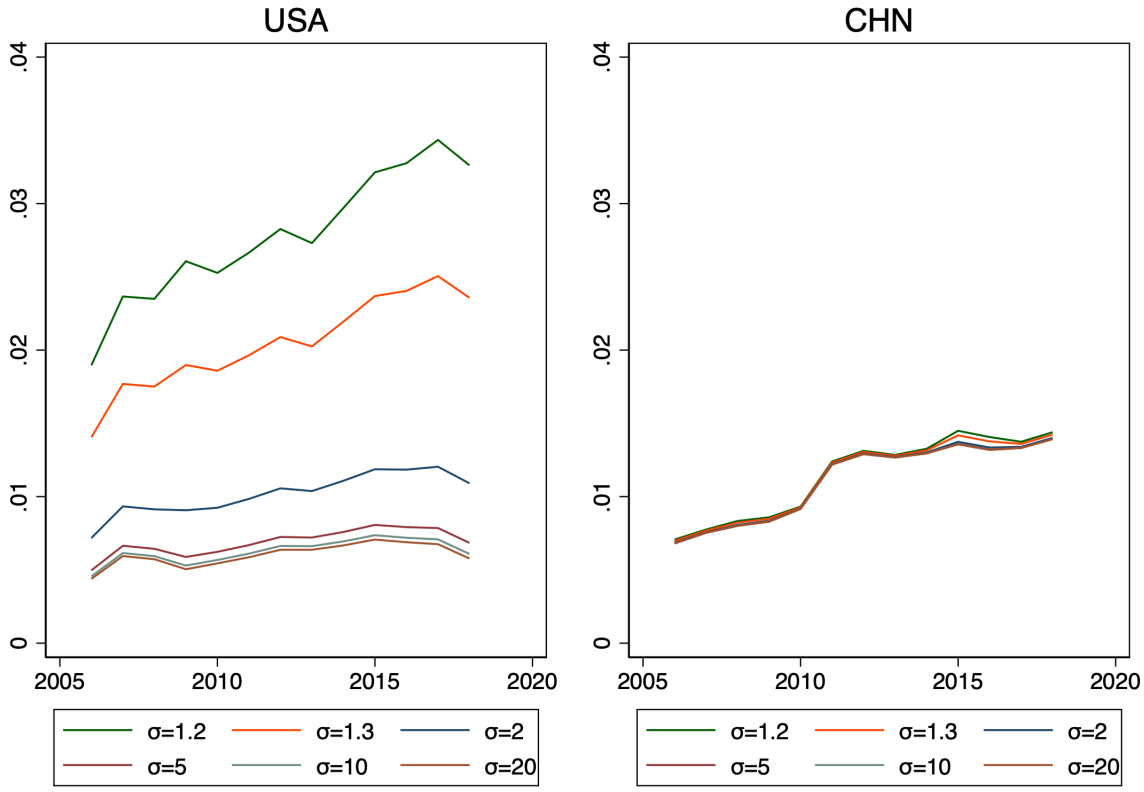
Finally, we define $\gamma_{iJ} = \log X_{iJ} - \sigma_J \log P_{iJ}$ and define $\gamma_{Jn} = -\sigma_J \log p_{Jn}$ to obtain

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

which gives the result.

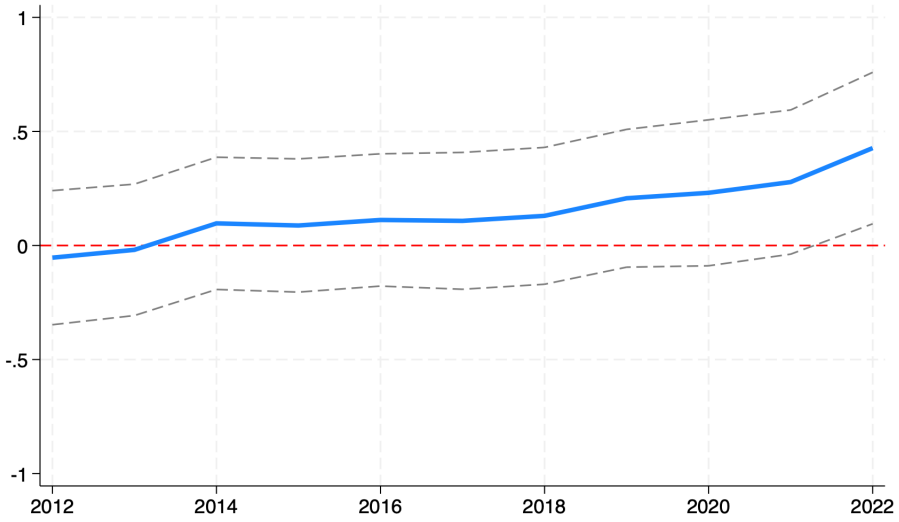
A.2 Empirical Appendix

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



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

Figure A.2: **Time Variation in θ_{tn}, Mean Agreement**



Notes: This figure reports the estimates of θ from the PPML estimation of Equation 21. The solid line is the point estimate and the dashed lines are two standard error bands. Here, we use the mean agreement between countries over the sample period rather than allowing agreement to vary year by year.