Power and Resilience:
A Theory of the National Security Externality

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March 21, 2025 – Version 1.4

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Abstract

This paper presents a theory of the national security externality and develops its implications for optimal economic statecraft. When countries bargain in the shadow of conflict, there is a strategic value to resilience to conflict because it improves bargaining power. Resilience depends on economic decisions, such as investment and trade patterns. There is a national security externality because bargaining power is not priced. The objective of economic statecraft is to intervene in the decisions that produce resilience to reduce the cost of the national security externality. Policies studied in this paper include investment subsidies to the defense industrial base, the reshoring and friend-shoring of production capacity, and various ways to weaponize trade, including sanctions. A quantitative exercise examines the value of reshoring productive capacity in a scenario where the United States faces a potential conflict with China over Taiwan. It suggests that industrial policy should target a narrow set of industries. The rise of China and the corresponding expansion of trade increased the importance of the national security externality and hence the value of reshoring by more than fivefold between 1997 and 2017.

*Scott Behmer and I initiated this project together, but because of other pressing commitments, he had to withdraw. I am extremely grateful for his many insights. I thank my advisors, Mike Golosov, Erik Hurst, James Robinson and Esteban Rossi-Hansberg for their guidance and support. I thank Rodrigo Adão, Fernando Alvarez, Chris Clayton, Luis Garicano, Robert Gulotty, Casey Mulligan, Kevin M. Murphy, Pascual Restrepo, Robert Shimer, Nancy Stokey, John Sturm Becko, and Felix Tintelnot for comments and suggestions.

1. Introduction

The rise of China and the outbreak of the war in Ukraine have put national security considerations at the top of the policy agenda. The war in Ukraine led to concerns that the defense industrial base had atrophied. The United States responded by developing its first-ever national defense industrial strategy. Similarly, trade disruptions caused by the pandemic showed that the United States had become reliant on China and Taiwan for critical imports such as semiconductors. The United States responded by passing the CHIPS Act to reshore semiconductor manufacturing capacity.

National security concerns are not necessarily a reason to intervene in markets. The decline of the defense industrial base may be an efficient response to declining military expenditures. While dependency on China may be bad for national security, if there is no externality, it can still be an efficient way to capture the gains from trade. That is what a theory is needed for: to provide a framework that explains why markets can fail to price national security considerations. Such a framework can then be used to clarify which policy instruments a nation should use and how they should be targeted to address the market failure.

This paper presents such a theory of the national security externality. The main implication of the externality is that markets underprovide domestic resilience to conflict and overprovide that of an adversary. It then develops the implications of this result for optimal economic statecraft. It shows that there is a strategic rationale for trade policy and industrial policy in the form of investment subsidies. It also develops the targeting of these policies both qualitatively and quantitatively.

The National Security Externality The national security externality is shown to exist in a model where two countries bargain in the shadow of conflict. Bargaining generates a strategic value for resilience to conflict. A country is referred to as more resilient if its costs of conflict are lower. The bargaining model is layered over a general equilibrium model with trade and investment. Investment and trade can affect resilience. The role of trade and industrial policy is then to manipulate trade and investment to improve domestic resilience and reduce that of an adversary.

There is a close analogy between the strategic value of resilience emphasized here and the more well-known strategic value of military power. Military power may be valuable because it is used on the battlefield or at the negotiating table. The destructive nature of war as an allocative mechanism means both parties have an incentive to avoid it. The strategy of conflict therefore views many conflict situations as bargaining situations, with a common incentive to bargain rather than fight. The study of strategy is therefore often not about the optimal *application* of force but about the *exploitation of potential force* (Schelling, 1960).

Bargaining power does not depend only on the balance of forces but also on the balance of resolve. A distinction therefore needs to be made between the value of resilience in *use* and in *diplomacy*. A country may want to be resilient to states of nature, such as earthquakes, because it expects them to happen with some strictly positive probability. This is its value in *use*. Markets optimally provide this type of resilience when markets are complete. A country may want to be resilient to the state of geopolitics because there is a strategic value of resilience. By lowering the cost of conflict, a country raises its potential willingness to engage in it. This potential willingness raises bargaining power. This is what creates the strategic value of resilience, or value in *diplomacy*.

There is a national security externality because markets do not price national bargaining power. This leads markets to not price the strategic value of resilience. They therefore underprovide domestic resilience and overprovide that of an adversary. This externality may matter more today than in the past. While many decisions regarding military power are made by the government, many decisions that affect resilience are made by markets instead. For example, it is the private sector that decides whether to produce semiconductors at home or in Taiwan. The expansion of global trade means that the scope for conflict to disrupt trade is greater. If the relative importance of private sector decisions in the production of resilience grew correspondingly, the national security externality may be more important today than in decades past.

The national security externality can provide a rationale for the uses of economic statecraft being pursued today. Because these policies intervene in markets and aim to affect resilience, the national security externality underpins their motivation. Specifically, this paper discusses investment subsidies to the defense industrial base, subsidies to bring production back home (reshoring), and subsidies to encourage the capacity to adjust or substitute in response to conflict. Trade policy aimed at redirecting capacity to countries from which one can continue importing during conflict (friendshoring) is also examined. Finally, sanctions and other ways of weaponizing trade are studied as methods of reducing an adversary's resilience.

Industrial Policy The first set of results pertains to investment subsidies on the return to capital. These are used to increase domestic resilience to conflict by manipulating the allocation of capital. Optimal subsidies encourage investment in capital goods whose prices appreciate more during conflict. This increases resilience because the prices of capital goods are informative about the effect of marginal investment on welfare. By subsidizing goods that appreciate in price during conflict, a government pushes investment toward capital goods that deliver high welfare during conflict relative to peace. This reduces the welfare difference between peace and conflict, thereby increasing resilience.

The first insight is that the sectors to be subsidized depend on the anticipated conflict shock. The expression for subsidies can provide a rationale for subsidies to the defense industrial base or for subsidies aimed at reshoring production. A larger defense industrial base increases resilience to conflict shocks that increase demand military production. If a larger fraction of final consumption is produced at home, a country may be more resilient to shocks that disrupt trade.

The second insight is that policy does not just affect what is produced but also which technology is used to produce it. Specifically, countries want to encourage the use of technologies that improve the capacity to adjust. For example, a country may encourage importing from an adversary through gas terminals rather than pipelines. If one gets cut off during a conflict, gas terminals can switch suppliers, but pipelines cannot. The former is more valuable during conflict and is therefore encouraged relative to the latter. Another example developed in the paper is investment in technologies that allow output to scale effectively during conflict.[1]

A third insight is that subsidies should target sectors in which domestic demand increases during conflict and that have relatively inelastic demand for capital. For conflicts that take the form of trade disruptions, this would involve sectors with high import exposure, a low elasticity of demand for the final output, and limited possibilities to substitute to other suppliers. This provides a possible rationale for subsidizing semiconductors. They are often considered a critical good; production of the most advanced semiconductors is concentrated in Taiwan, and it is difficult to produce, so other countries presumably cannot ramp up production rapidly, making it hard to substitute.

Trade policy Aimed at Domestic Resilience The second set of results pertains to the use of trade policy to increase domestic resilience. A country does so by using trade to influence the capital stock in third countries. Since the allocation of capital across countries affects prices, this has terms-of-trade effects. A country can increase resilience by manipulating the foreign capital stock to generate terms-of-trade gains during conflict relative to peace.

Suppose the United States anticipates being cut off from semiconductors during a conflict over Taiwan. It expects to increase imports from South Korea in such a scenario. By importing more during peace, it increases the capital stock in the Korean semiconductor sector, thereby shifting out the short-run supply curve. This lowers import prices for any given quantity of imports during conflict and thus improves the terms of trade during conflict. This can increase resilience through a policy resembling friendshoring.

Interestingly, trade policy is not used to protect domestic capacity. There is a classical argument (going back at least to Smith (1776)) that suggests trade should be restricted if it weakens domestic capacity in sectors relevant to national security. The model is consistent with the premise that production capacity has strategic value but shows that the conclusion does not follow. The reason is that restricting trade violates the targeting principle. If productive capacity is to be protected, it should be targeted directly through investment subsidies. Therefore, a small open economy should

[1]These are both examples of using different technologies to produce the same output. Since the return on capital equals the value marginal product, these policies target technologies with a high marginal product of capital during conflict.

not distort trade. The unilateral argument for laissez-faire trade policy holds even when the national security externality is present.

Trade Policy Aimed at an Adversary's Resilience The last set of results pertains to the use of trade policy to reduce an adversary's resilience. It is a mirror image of the policies used to increase domestic resilience. By using trade policy to reallocate an adversary's capital stock, a country can reduce that adversary's resilience. In practice, this involves making the terms of trade move against the adversary during conflict.

The "reverse industrial policy" rationale for trade policy leverages trade to pull capital into sectors whose prices are low during conflict. The reason this reduces resilience is analogous to how investment subsidies increase resilience. For example, suppose Russia sells gas cheaply to Germany. This induces German firms to invest in heavy industries reliant on cheap gas, thereby making Germany more exposed to a conflict in which it loses access to gas.

Trade policy is used to improve the adversary's terms of trade during peace while reducing it during conflict. This makes peace more attractive and conflict more costly, thereby decreasing the adversary's resilience. Making peace more attractive can mean engaging less in terms-of-trade manipulation and moving toward free trade; hence, the national security externality does not necessarily imply less trade. Making conflict more costly can involve choosing trade taxes above the terms-of-trade–maximizing levels, resembling a form of sanctions.

Quantitative Conflict Scenario Analysis An interesting feature of the optimal investment subsidies is that they depend on a counterfactual. A strategist needs to know how investment prices would move if a conflict were to occur. This is a sufficient statistic that is hard to observe directly in practice because wars between great powers are few and far between. This observation is closely tied to the national security externality. The observation that war is rare while countries have many political disagreements suggests they mostly bargain rather than fight. This is what generates the strategic value of resilience that underpins the externality in the first place.

This is a familiar problem for military planners. It has been a long time since the U.S. Navy fought a major war in the Pacific. Military planners therefore often study the outcomes of war games. These are simulations that take a conflict scenario—such as a war over Taiwan—and combine available information about military capabilities to detect possible vulnerabilities.

The final section of the paper takes a similar approach. It uses a quantitative trade model that is calibrated using available information on trade patterns, the U.S. input-output structure, and trade elasticities to study a conflict scenario in which the United States and China fight over Taiwan.[2] The

[2]Quantitative economic models and military wargames are both tools that help analysts study counterfactuals for which recent history may not provide adequate analogies. There are also differences. In quantitative economic models, the main decision makers that determine the outcomes are the agents within the model. War games, on the other hand,

exercise emphasizes the trade aspect of such a conflict by feeding the model large iceberg trade shocks. These shocks result in the United States losing access to trade with both China and Taiwan.

The analysis ranks sectors according to the strategic value of additional capital. The first main insight is that additional capital is most valuable in sectors that (i) have high import exposure to China and Taiwan and (ii) exhibit low trade elasticity; these are often more advanced technologies. The second insight is that the strategic value of capital declines rapidly as one moves down the rankings. This implies that the optimal policy targets a fairly narrow set of highly exposed industries.

The analysis also suggests that the value of targeting the ten percent most exposed sectors has increased substantially over time. The value of additional capital in these sectors increased by 500 percent between 1997 and 2017. This development closely tracks the growth of trade with China. It suggest the importance of the national security externality has grown with the expansion of international trade.

Related Literature This paper connects two strands of ideas that emphasize how things can have strategic value. The first is the classic work by Schelling (1960) and Schelling (1966), which studies conflict as a bargaining problem. They develop the idea that national security policy is often not about how a country should fight a conflict but how a country should position itself in the shadow of one. Many of the national security applications in these works focus on the strategic use of conventional military force and nuclear weapons. This paper suggests that if one is interested in studying the use of economic policy for national security purposes, one should instead focus on resilience as a source of power.

The second is the work by Hirschman (1945), who points out that even if war is ruled out, countries can still employ threats through trade to strengthen their bargaining position. Hirschman terms this the influence effect of international trade. A more modern treatment is provided by McLaren (1997), who develops a formal model that produces dependency by combining bargaining with an irreversible investment decision in capital. This paper shows that the dependency effect does not depend on trade but instead on adverse economic shocks, of which trade can be one.

There is a broader literature that studies war as a bargaining problem. In an influential article, Fearon (1995) argues that explaining the central puzzle of war—namely, that it is costly but still occurs in equilibrium—requires some type of bargaining failure, such as asymmetric information or limited commitment. Some of the main ideas of this literature are reviewed in Baliga and Sjöström (2013) and Baliga and Sjöström (2024). Especially relevant to the present paper are Martin et al. (2008) and Thoenig (2023), who layer a bargaining model with asymmetric information over a general equilibrium model with trade to study the effect of trade on the probability of war.

are played by people, and part of their purpose is to train them how to behave in strategic environments.

This paper is most closely related to the nascent literature on geoeconomics. Some of these ideas are reviewed in Mohr and Trebesch (2024).[3] Three papers that are especially relevant are Clayton et al. (2023), Clayton et al. (2024), and Becko and O'Connor (2024). The first two focus on a framework with incomplete contracts between firms, modeling how states can leverage an economy to exert power. By contrast, this paper uses a general equilibrium model in which agents trade through spot markets and features sticky capital, a key element not present in their framework. Becko and O'Connor (2024) use a bargaining framework to study how a country should set trade and investment policy when trade is a point of leverage in geopolitical conflict. However, they do not develop the national security externality emphasized here. While their focus is on trade policy to coerce an adversary, the main emphasis in this paper is on the use of policy to raise domestic resilience. In their baseline model, there is no role for investment policy.[4] They also do not examine the use of trade policy to raise domestic resilience.

The result on sanctions in this paper relates to work by Osgood (1957) and Sturm (2022), who derive similar expressions. However, the role of sanctions differs across studies. In this paper, sanctions increase bargaining power by reducing an adversary's resilience to conflict. In Osgood (1957), sanctions reduce an adversary's military expenditure, while in Sturm (2022), a country is assumed to have preferences for harming another country. Alekseev and Lin (2024) study how trade policy can raise an adversary's cost of producing military goods.[5]

Other related work on national security policy does not emphasize the national security externality studied here; see, for example, Thompson (1979) and Murphy and Topel (2013). Acemoglu et al. (2012) study optimal resource extraction taxes in a model of resource wars, emphasizing limited commitment rather than bargaining power as the rationale for policy intervention. By contrast, this paper develops an argument for policy use to increase resilience based on a model of geopolitics. Recent work by Grossman et al. (2023a), Grossman et al. (2023b), and Acemoglu and Tahbaz-Salehi (2024) examines optimal policy to enhance resilience in supply chains. The role of policy in these papers is to alleviate frictions originating in supply chain formation rather than in geopolitics.

Outline The paper is structured as follows. Section 2 introduces the national security externality in a simple closed economy. Section 3 presents a general model to develop the implications for pol-

[3]This literature builds on ideas from the economic statecraft literature within political science. Baldwin (1985) synthesizes and expands on many issues discussed in earlier works. This includes early contributions by economists such as Schelling (1958), Wu (1952), and Osgood (1957), who study the role of economic policy in the context of the Cold War. Partly in response to China's Belt and Road Initiative, interest in these issues grew through contributions by Blackwill and Harris (2016) and Farrell and Newman (2019).

[4]Becko and O'Connor (2024) do introduce a role for investment subsidies by adding a commitment constraint, but the various implications of the optimal investment subsidy developed in this paper are not explored there.

[5]The economics literature on sanctions has expanded substantially following the Russian invasion of Ukraine. It is reviewed by Morgan et al. (2023). Recent contributions include Bianchi and Sosa-Padilla (2023) and De Souza et al. (2024).

icy. Section 4 shows how trade and investment policy can be used to increase domestic resilience. Section 5 shows how trade policy can be used to reduce an adversary's resilience. Section 6 presents the quantitative exercise. Section 7 concludes.

2. National Security Externalities

This section introduces a model of bargaining in the shadow of conflict, shows when it leads to a national security externality, and from there develops the national security rationale for investment subsidies. Section 2.1 studies the economy from the perspective of the planner. Section **??** describes the competitive equilibrium that is used to decentralize the planner allocation. Section 2.3 explains when the competitive equilibrium is inefficient in the absence of policy and how investment subsidies can be used to restore efficiency. Section 2.4 interprets the externality as a missing market for bargaining power by constructing markets for power. Section 2.5 discusses two extensions of the bargaining environment.

2.1 Bargaining and the Problem of the Government

This section introduces a model of bargaining and investment from the planner's perspective. It formalizes the first two premises of the paper; (i) bargaining induces countries to value resilience, as it increases bargaining power and (ii) resilience is produced by economic decisions.

Bargaining in the shadow of conflict The economy consists of two countries, Sovereign and Adversary, denoted by $i \in \{S, A\}$. They bargain in the shadow of conflict. If countries agree on some division of the prize, they implement that and there is peace, otherwise there is conflict and they "fight". These states of geopolitics are denoted by $z \in \{P, C\}$. Peace acts as the inside option and conflict as the outside option. Bargaining outcomes follow the generalized Nash bargaining solution and hence depend on resilience - the difference in welfare in the inside and outside option. This generates the strategic value for resilience since bargaining never fails in the baseline model.

Economic block The role of the economic block is threefold. First, it provides a microfoundation for the cost of conflict. Second, it introduces that strategic decisions can influence a country's resilience to conflict. Lastly, it allows for a discussion of policy when market prices do not induce atomistic agents to solve the same social problem as the government. This section uses a minimalist economic block. Section 3 generalizes it to study implications for policy.

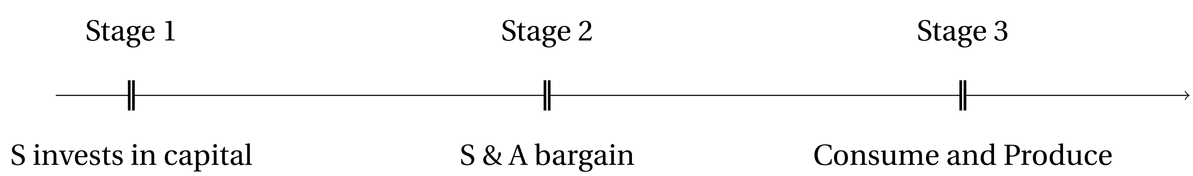
Sovereign and Adversary are closed economies inhabited by a representative agent. There are two market goods, $g \in \{0, 1\}$, that are produced using sector-specific capital. Sector 0 is a numeraire good while sector 1 is the defense sector. The main economic decision of interest is an irreversible investment in sector-specific capital made before bargaining. The state of geopolitics enters the economic block only through government demand for the defense sector. This demand increases by an exogenous amount during conflict as compared to peace.

Both assumptions are necessary. For capital investment to affect Sovereign's incentive constraint it needs to be the case that capital investment is sticky and that the demand for capital differs between peace and conflict. The assumption that government demand increases implies both that capital demand differs.[6]

The assumption that defense output increases has another appealing implication. Conflict is an inefficient way to redistribute the bargaining good — since those are assumed to be in fixed supply. This is an appealing implication since much of the rationale for studying the strategy of conflict as a bargaining problem is that conflict is something all parties should wish to avoid on the equilibrium path.

Timing The timing of the economy is displayed in Figure 1. There is an initial stage where Sovereign chooses capital investment and commits to its geopolitical action. In stage 2, Sovereign and Adversary bargain, thereby determining z. In stage 3, each country uses its capital stock to maximize household welfare given the realization of z.

Figure 1: Timing of the economy



2.1.1 Stage 3: Consumption and Production

A country i arrives in stage 3 with a stock of sector-specific capital $\bar{k}_g^i$ and a supply of bargaining goods denoted by $B^{i,z}$. Each government uses the capital stock to maximize the welfare of the domestic household. Their preferences are given by

$$U^{i,z} = B^{i,z} + u^i(c_0^{i,z}, c_1^{i,z}) \quad \text{where} \quad u^i(c_0^{i,z}, c_1^{i,z}) = c_0^{i,z} + v(c_1^{i,z}).$$

[6]The assumption that defense demand increases is not the only way to generate demand shifts for capital between peace and conflict. The richer economic block discussed later allows conflict to take the form of preference, technology, and trade shocks. The idea that part of the cost of conflict arises from the interaction between the change in trade caused by conflict and the stickiness of capital goes back at least to Ricardo (1821).

Output $y_g^{i,z}$ is produced using a sector-specific capital good $k_g^{i,z}$. Output is used for consumption $c_g^{i,z}$ or defense $d_g^{i,z}$. As mentioned, defense expenditure is exogenous and increases during conflict, i.e., $d_g^{i,C} > d_g^{i,P}$. The market for goods and capital must clear. The technology, goods market clearing, and capital market clearing conditions are respectively given by

$$y_g^{i,z} = k_g^{i,z} \tag{1}$$
$$y_g^{i,z} = c_g^{i,z} + d_g^{i,z} \tag{2}$$
$$k_g^{i,z} = \bar{k}_g^i. \tag{3}$$

The consumption component of welfare obtained by a country i is then described by the following maximization problem:

$$V^{i,z}(\bar{k}_0^i, \bar{k}_1^i) \equiv \max_{\{c_0^{i,z}, c_1^{i,z}\}} u^i(c_0^{i,z}, c_1^{i,z}) \qquad \text{subject to (1)-(3)} . \tag{4}$$

This is referred to as stage 3 welfare (since $B^{i,z}$ is determined in stage 2). To ease exposition, capital will often be suppressed from the notation.

2.1.2 Stage 2: Bargaining in the Shadow of Conflict

In stage 2, the countries engage in Nash bargaining over the allocation of the bargaining good. They enter this stage knowing their allocation of capital and can therefore anticipate welfare in stage 3.

The total amount of the bargaining good is assumed to be in fixed supply:

$$B^{S,z} + B^{A,z} = \bar{B}. \tag{5}$$

The supply of the bargaining good is assumed to be sufficiently large so that it can always be used to transfer utility during bargaining.

Bargaining works as follows. Whenever the surplus from peace is not positive, there is conflict, and the allocation of the bargaining good is exogenous and denoted by $B^{i,C}$. Whenever the surplus from peace is positive, there is peace, and $B^{S,P}$ follows the generalized Nash bargaining solution. The surplus from peace is positive whenever

$$V^{S,P} + V^{A,P} > V^{S,C} + V^{A,C}. \tag{6}$$

Since the presumption of this paper is that bargaining is an appealing framework precisely because it allows countries to avoid conflict, this condition will always be assumed to hold. In this simple example, it can be guaranteed through restrictions on fundamentals, but later on, it will be a maintained assumption.

Generalized Nash Bargaining The generalized Nash bargaining solution determines an allocation of the bargaining good during peace as a function of bargaining weights, the allocation of the bargaining good during conflict, and most importantly, resilience to conflict. A country is more resilient to conflict if its welfare loss during conflict is lower. That is, when

$$R^i \equiv V^{i,C} - V^{i,P} \tag{7}$$

is higher, it is more resilient. The division of the bargaining good according to the generalized Nash bargaining solution solves

$$\begin{aligned} (B^{S,P}, B^{A,P}) \in \text{argmax} \left(B^{S,P} - R^S - B^{S,C}\right)^{\theta^S} \left(B^{A,P} - R^A - B^{A,C}\right)^{\theta^A} \\ \text{subject to} \quad (5) \end{aligned}$$

where bargaining weights sum to one, $\theta^S + \theta^A = 1$. The allocation that results from this problem implies that Sovereign's bargaining good during peace increases in its own resilience to conflict and declines in that of Adversary,

$$B^{S,P} = \theta^A R^S - \theta^S R^A + B^{S,C} \tag{8}$$

$$= \theta^A \left(V^{S,C} - V^{S,P}\right) - \theta^S \left(V^{A,C} - V^{A,P}\right) + B^{S,C}. \tag{9}$$

Definition 1 (Equilibrium)**.** *Given* $\left\{\bar{k}_g^i\right\}$*, an equilibrium consists of an allocation of bargaining good* $\left\{B^{i,z}\right\}$ *and a* Z *that follow the bargaining procedure, and an allocation of capital, consumption, and production* $\left\{k_g^{i,Z}, c_g^{i,Z}, y_g^{i,Z}\right\}$ *that solve programs in* (4).

Note that Sovereign's investment decision and geopolitical commitment are not part of the equilibrium definition. They are treated as what Schelling (1960) refers to as strategic moves—decisions made before the game to improve one's equilibrium outcomes. This equilibrium definition is closer to the common definition of a competitive equilibrium used in public finance, which takes policy objects like taxes as given, than it is to the common equilibrium definition in political economy that would treat policy as part of the equilibrium. This aligns with this paper's emphasis on optimal policy prescription.[7]

[7] The study of the strategy of conflict often emphasizes Nash equilibria because the modeler seeks to explain real-world phenomena. Schelling (1960) begins by discussing another reason to study the strategy of conflict: "We may be involved in a conflict ourselves; we all are, in fact, participants in international conflict, and we want to *win* in some proper sense." This is the perspective taken in this paper. National security policy is about "winning" in international politics. Dixit (2006) notes that while modern game theory often defines policy as part of the game, Schelling's approach

2.1.3 Stage 1: Investing in Capital

Both countries receive an endowment of capital $\bar{k}^i$. This capital good is invested before bargaining into sector-specific capital goods $\bar{k}^i_g$. It is assumed that a unit of the endowment can be transformed into a unit of the sector-specific capital good. This implies that the investment constraint is linear, that is,

$$\bar{k}^i_0 + \bar{k}^i_1 = \bar{k}^i. \tag{10}$$

Sovereign chooses its capital allocation, while Adversary's is treated as exogenous.

2.1.4 Decision Problem

Power and the Demand for Resilience Equation (8) captures the first central premise of this paper: resilience produces bargaining power. Substituting equation (8) and (9) into the utility function leads to a simple expression for welfare,

$$W^S = V^{S,P} + \theta^A R^S - \theta^S R^A + B^{S,C} \tag{11}$$

$$= V^{S,P} + \theta^A(V^{S,C} - V^{S,P}) - \theta^S(V^{A,C} - V^{A,P}) + B^{S,C}. \tag{12}$$

Bargaining introduces a demand for resilience to conflict. This, in turn, induces the state to adopt other-regarding preferences. It values the Adversary's welfare during peace and conflict because it affects bargaining outcomes.

Planning Problem The problem of Sovereign is to split the capital endowment into sector-specific capital goods to maximize welfare. The government understands that investment not only generates output for consumption but also produces resilience to conflict. Its maximization problem is given by

$$\max_{\bar{k}^S_0, \bar{k}^S_1} \quad V^{S,P}(\bar{k}^S_0, \bar{k}^S_1) + \theta^A \left(V^{S,C}(\bar{k}^S_0, \bar{k}^S_1) - V^{S,P}(\bar{k}^S_0, \bar{k}^S_1)\right) + \mathcal{Z} \qquad \text{subject to (10)} \tag{13}$$

where $\mathcal{Z} \equiv \theta^S \left(V^{A,C} - V^{A,P}\right) + B^{S,C}$.

Optimal Investment and Strategic Moves The optimality condition of the government is given by:

$$\frac{\partial V^{S,P}(\bar{k}^S_0, \bar{k}^S_1)}{\partial \bar{k}^S_g} + \theta^A \left(\frac{\partial V^{S,C}(\bar{k}^S_0, \bar{k}^S_1)}{\partial \bar{k}^S_g} - \frac{\partial V^{S,P}(\bar{k}^S_0, \bar{k}^S_1)}{\partial \bar{k}^S_g}\right) = \hat{\mu}^S \tag{14}$$

may be more natural for the prescriptive questions often studied by Schelling.

where $\hat{\mu}^S$ is the multiplier on the investment constraint for the government. This expression captures the second key premise of the paper: economic decisions can affect bargaining power by affecting resilience to conflict. The first term of this expression captures the standard neoclassical consumption benefit of capital; by investing slightly more, the household can ultimately consume slightly more. The second term captures the strategic value of capital: by investing slightly more, a country may increase (decrease) its resilience to conflict and thereby improve (worsen) bargaining outcomes.

2.1.5 Discussion and Interpretation

The use of bargaining models was motivated by pointing out that bargaining is a more efficient way to leverage power than military force. The decision to choose between bargaining or violence was not explicitly modeled; instead, bargaining was imposed directly. This simplifies exposition while still capturing the key premise: bargaining induces countries to value resilience.

Countries bargain over many things, so the bargaining good should be interpreted broadly. It may reflect contested territory, adherence to demilitarized zones, or human rights. The exact benefits of increasing bargaining power are not modeled in detail, so the emphasis lies on the means of obtaining power — increasing resilience.

When interpreting the bargaining good as territory, there is no need to think of countries as formally owning that territory. Consider the Munich Agreement: we would consider it a bargaining process between Germany, Britain, and France, even though the concession granted to avoid war was the Sudetenland. Similarly, the Taiwan question is interpreted as a bargaining problem between China and the US. This type of interpretation is most appealing when the country that owns the territory is much weaker than the two bargaining parties.

2.2 Competitive Equilibrium

This section describes the agents and market structure used to decentralize the optimal allocations characterized above as a competitive equilibrium. It formalizes the last two premises of the paper: (i) the decisions that produce resilience are made by atomistic agents, and (ii) there is no market that directly rewards them for the production of resilience.

There are three types of agents. The most important agent is an investment firm operating in Stage 1. It owns the initial capital stock, $\bar{k}^i$, and invests it in sector-specific capital. It understands there is peace along the equilibrium path and hence evaluates the return to capital according to $r_g^{i,P}(1+s_g^i)$, where $r_g^{i,z}$ is the price of a capital good g in state z and s_g^i is an ad-valorem subsidy the government can use to address the national security externality. The other two agents operate in stage 3. There is a representative household that collects all income, pays a lump-sum tax $T^{i,z}$, and uses the remaining income to purchase goods for consumption at output prices $p_g^{i,z}$. Lastly, there is a representative production firm for each g which purchases sector-specific capital and uses it to produce output, which it then sells.

2.2.1 Stage 3 Agents and Decisions

Both the household and the production firms only make a decision in stage 3 once z and $B^{i,z}$ are determined. Their decision problems are respectively given by

$$\left(c_0^{i,z}, c_1^{i,z}\right) \in \operatorname{argmax} \left\{ B^{i,z} + u^i(c_0^{i,z}, c_1^{i,z}) \middle| \sum_{g \in \{0,1\}} p_g^{i,z} c_g^{i,z} + T^{i,z} = \Pi^{i,z} \right\} \tag{15}$$

$$\left(y_g^{i,z}, k_g^{i,z}\right) \in \operatorname{argmax} \left\{ p_g^{i,z} y_g^{i,z} - r_g^{i,z} k_g^{i,z} \middle| y_g^{i,z} = F_g^i(k_g^{i,z}) \right\} \tag{16}$$

where, $p_g^{i,z}$ is the price of good g in a state z, and $r_g^{i,z}$ is the price of a unit of capital. $\Pi^{i,z}$ represents total income from profits, which sums profits from the investment and production firms and accrues to the household, while $T^{i,z}$ is a lump-sum tax that balances the government budget:

$$\Pi^{i,z} = \sum_{g \in \{0,1\}} \left(p_g^{i,z} y_g^{i,z} - r_g^{i,z} k_g^{i,z}\right) + \sum_{g \in \{0,1\}} r_g^{i,z}(1 + s_g^i)\bar{k}_g^i \tag{17}$$

$$T^{i,z} = \sum_{g \in \{0,1\}} r_g^{i,z} s_g^i \bar{k}_g^i + \sum_{g \in \{0,1\}} p_g^{i,z} d_g^{i,z} \tag{18}$$

Stage 1 Agents The investment firm owns the initial capital stock and invests it to maximize profits. It understands that there is peace along the equilibrium path and so it uses $r_g^{i,P}$ to compute the return on capital. It also receives an ad-valorem subsidy, s_g^i, on the return to capital. The investment firm is assumed to take both the returns and subsidy as given because it is atomistic. This description of the investment firm captures the third premise. Its investment decision solves the following maximization problem;

$$(\bar{k}_0^i, \bar{k}_1^i) \in \operatorname{argmax} \left\{ \sum_{g \in \{0,1\}} r_g^{i,P}(1 + s_g^i)\bar{k}_g^i | \bar{k}_0^i + \bar{k}_1^i = \bar{k}^i \right\}. \tag{19}$$

Given that there is peace along the equilibrium path, a competitive equilibrium is defined as follows:

Definition 2 (A competitive equilibrium)**.** *Given subsidies* $\{s_g^i\}$*, a competitive equilibrium consists of prices* $\left\{p_g^{i,z}, r_g^{i,z}\right\}$*, an allocation of capital, consumption, and production* $\left\{k_g^{i,z}, c_g^{i,z}, y_g^{i,z}\right\}$*, an investment decision* $\{\bar{k}_g^i\}$ *and a lump-sum transfer* $T^{i,z}$ *that satisfy* (1)*-*(3) *and* (15)*–*(19)

2.3 The national security externality and optimal policy

We now turn to the national security externality and the argument for national security policy. First, I show the competitive equilibrium does not maximize Sovereign's welfare because it effectively overvalues consumption relative to bargaining power. Next, I show how investment subsidies can be used to implement the first-best allocation.

2.3.1 The National Security Externality

To show that there is a national security externality and that the competitive equilibrium does not maximize domestic welfare, we show that the competitive equilibrium effectively solves a different planning problem than that of the government.

The first-order condition of the investment firm in the absence of policy is given by:

$$r_g^{S,P} = \mu^S \tag{20}$$

where μ^S is the multiplier on the investment constraint for the firm in (15). To relate this first-order condition to that of a planning problem, we collect the first-order conditions associated with the household consumption decisions, the firm production decision, and the envelope condition of (13). This yields:

$$\frac{\partial u^{S,z}}{\partial c_g^{S,z}} = p_g^{S,z} \quad , \quad p_g^{S,z}\frac{\partial F_g^{S,z}}{\partial k_g^{S,z}} = r_g^{S,z} \quad \text{and} \quad \frac{\partial V^{S,z}}{\partial \bar{k}_g^S} = \frac{\partial u^{S,z}}{\partial c_g^{S,z}}\frac{\partial F_g^{S,z}}{\partial k_g^S}. \tag{21}$$

where the price of good 0 was normalized such that the marginal utility of income is unity. Combining these expressions allows us to express the marginal value of capital in terms of market prices:

$$\frac{\partial V^{S,z}}{\partial \bar{k}_g^S} = r_g^{S,z}. \tag{22}$$

Here we see that market prices do not value the bargaining power that capital provides. Consequently, the allocation of capital generated by a competitive market effectively solves the following planning problem:

$$\left(\bar{k}_0^S, \bar{k}_1^S\right) \in \text{argmax}\left\{B^{S,P} + V^{S,P}(\bar{k}_0^S, \bar{k}_1^S) | \bar{k}_0^S + \bar{k}_1^S = \bar{k}^S\right\} \tag{23}$$

where $B^{S,P}$ is taken as given. That is, the market effectively ignores the effect of capital investment on bargaining power. In this sense, markets overemphasize efficiency at the expense of bargaining power or national security considerations. Section 2.4 interprets it as a missing market for power.

2.3.2 Optimal National Security Policy

The social role of national security policy is to intervene directly in the decisions that produce resilience in order to reduce the social cost of the national security externality. In the economy studied here, policy can achieve the first-best outcome. The first-order condition of the firm in the presence of policy is given by:

$$r_g^{S,P}(1 + s_g^S) = \mu^S. \tag{24}$$

To solve for the optimal subsidies, I combine the government's and investment firm's first-order conditions with (22). One then obtains the following proposition.

Proposition 1. *Optimal investment subsidies are given by*

$$s_g^S = \theta^A \left(\frac{r_g^{S,C}}{r_g^{S,P}} - 1\right). \tag{25}$$

A government would want to subsidize those capital goods that appreciate in price during conflict. The reason is that it is precisely these capital goods that contribute most to resilience, as they have a relatively high impact on welfare during conflict, as can be seen from (22).

Implications of Investment Subsidies The price movement of capital in this section is driven by conflict-induced shifts in the demand for defense output. It therefore provides a rationale for investment subsidies to the defense industrial base. Section 4.1 shows that it generalizes to much more general open economy models. It will be shown that the expression can be used to think about bringing production capacity back home, how optimal targeting is related to sectoral fundamentals, and investment in scalable technologies. The economy here is too simple to develop those points, and the discussion of all the implications of equation (25) is presented in Section 4.1.

Graphical Interpretation Figure 2 displays the deadweight cost caused by the national security externality in a Marshallian diagram. In the model, the supply of capital to sector 1 is perfectly elastic along the peace equilibrium path. Once stage 3 is reached, it is perfectly inelastic. The peace equilibrium thus corresponds to the Marshallian long run in which capital adjusts, while stage 3 corresponds to the short run. The equilibrium in the absence of policy lies on the intersection of the peace demand curve and the long-run supply curve (LRS).

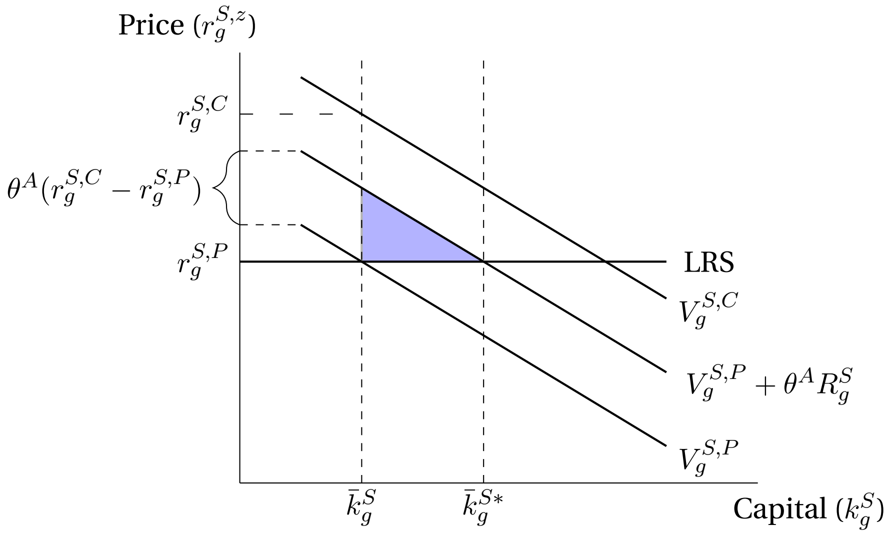


Figure 2: The cost of underinvestment in sector 1

Subsidies and Demand Figure 2 shows that there is room for policy only if there is a shock during conflict that moves the demand for capital. There is underinvestment whenever the demand curve shifts outward during conflict. The ad-valorem subsidy can address this distortion by also shifting out the long-run demand curve by $r_g^{S,P} s_g$. The optimal allocation can be implemented by constructing the subsidy so that the outward shift of the long-run demand curve equals the wedge, i.e., $r_g^{S,P} s_g^S = \theta^A(r_g^{S,C} - r_g^{S,P})$. Rearranging this expression leads to equation (25).

Subsidies and the Counterfactual While the optimal subsidies only depend on a sufficient statistic, that sufficient statistic depends on the fundamentals. Here those are captured by the shape of the demand curve. A strategist would often not know the sufficient statistic since it involves a counterfactual with a hypothetical conflict. To obtain the sufficient statistic, a strategist can take a stance on the conflict shock and model the fundamentals of an economy directly to effectively capture the shift and elasticity of the demand for capital. Section 6 conducts this exercise through a quantitative trade model.

2.4 The National Security Externality as a Missing Market Problem

This section used a competitive equilibrium with subsidies to implement Sovereign's optimal allocation of capital. A planner needs an investment subsidy for every capital good to be able to decentralize the desired allocation.[8] This suggests that investment subsidies do not target the externality directly, since a single externality usually only requires one policy instrument. This section shows that if markets are constructed on a simple measure of bargaining power, then subsidies are not needed.

Commodifying Power The commodity that is introduced here is labeled bargaining power. Suppose that we conceive of a fictional commodity labeled bargaining power. A simple measure of bargaining power is obtained by rearranging equation (8):

$$BP^S = B^{S,P} - B^{S,P}_{sq} = \theta^A R^S - \theta^S R^A + B^{S,C} - B^{S,P}_{sq} \tag{26}$$

Here, $B^{S,P}_{sq}$ is some arbitrary benchmark status quo allocation. Combining this definition of bargaining power with the market-clearing condition for the bargaining good implies that power is in zero net supply:

$$BP^S + BP^A = 0 \tag{27}$$

Suppose that any time the investment firm makes an investment that increases bargaining power, it is assigned a bargaining credit by the government. For expositional simplicity, assume that firms are assigned property rights over bargaining power and that they are awarded a bargaining credit for every unit of bargaining power. Suppose that the government commits to buy any outstanding bargaining power credits at some given price $p^{S,P}_{BP}$. The total revenue of the firm obtained from bargaining power credits is $p^{S,P}_{BP} BP^S$.

The investment problem of the firm becomes

$$(\bar{k}^S_0, \bar{k}^S_1) \in \text{argmax} \left\{ \sum_{g\in\{0,1\}} r^{S,P}_g \bar{k}^S_g + p^S_{BP} BP^S(\bar{k}^S_0, \bar{k}^S_1) \,\middle|\, \bar{k}^S_0 + \bar{k}^S_1 = \bar{k}^S \right\}. \tag{28}$$

The associated first-order condition is given by

$$r^{S,P}_g + p^S_c \frac{\partial CP^S}{\partial \bar{k}^S_g} = \frac{\partial V^{S,P}}{\partial \bar{k}^S_g} + p^S_c \left(\frac{\partial V^{S,C}}{\partial \bar{k}^S_g} - \frac{\partial V^{S,P}}{\partial \bar{k}^S_g} \right) = \mu^S. \tag{29}$$

The Price of Power The optimal price of power follows immediately by comparing (29) with the optimality condition of the planner (14). When the marginal utility of income is normalized to one, the price that implements the planner's optimal allocation equals the shadow value on the resource

[8] This section only has two capital goods, and good 0 does not require capital subsidies. The many capital goods case is developed in Section 4.

constraint:

$$p^S_{BP} = 1. \tag{30}$$

The main point is that the role of investment subsidies for the different capital goods here is to replicate the allocation that could be attained by choosing a single market price for bargaining power. Note that assigning a single market price is not necessarily simpler than assigning heterogeneous investment subsidies. The government still has to assign the bargaining credits based on the heterogeneous contribution of various investments to bargaining power.

2.5 Extensions to the Bargaining Environment

This section considers two extensions to the bargaining environment described above. It first studies the case with asymmetric information, which can lead to conflict in equilibrium. Next, it studies a standard guns-and-butter model by explicitly modeling the benefit of military production through a contest function.

2.5.1 Asymmetric Information

In the baseline model, bargaining is efficient and therefore conflict is avoided in equilibrium. This meant there was only a strategic value to resilience. This section introduces asymmetric information, which allows conflict to occur in equilibrium.[9] This introduces a reason to value resilience—conflicts can now happen with a positive probability.

Ultimatum Game Bargaining during stage 2 now takes the form of an ultimatum game. Adversary suggests a split of the bargaining good with probability θ^A. In the case of complete information, this would generate a strategic value for resilience that is identical to the baseline model. Uncertainty is introduced by letting Sovereign draw an additive preference shock over the cost of conflict it has invested. The full setup with asymmetric information is somewhat involved and therefore relegated to Appendix A.1. The probability of conflict when Adversary makes an offer is denoted by $\mathcal{P}^{A,z}$.

Optimal Subsidies Let $B^{S,P}_A$ denote the bargaining goods Sovereign obtains during peace when Adversary makes an ultimatum. Then the optimal subsidy is given by

$$s^{S,P}_g = \theta^A \mathcal{P}^{A,P} \frac{\partial B^{S,P}_A}{\partial R^S} \left(\frac{r^{S,C}_g}{r^{S,P}_g} - 1 \right). \tag{31}$$

[9]Asymmetric information is discussed by Fearon (1995) as an explanation of why costly wars can happen in equilibrium.

The derivation is found in Appendix A.1. Two aspects of this expression are particularly noteworthy. First, the effect of capital investment on the probability of conflict does not appear. Second, the optimal subsidies decrease as the (conditional) probability of conflict $\mathcal{P}^{A,C} = 1 - \mathcal{P}^{A,P}$ increases.

Why does the effect of investment on the probability of war not matter? The reason is that a government gets to optimize over the probability of conflict. This means that the envelope theorem applies, and small changes to the probability of conflict do not have first-order effects on welfare. Countries get to optimize over the probability of conflict either because they choose to reject an offer when it is optimal to do so, or they optimize over the probability that another country rejects their offer.

Why does the optimal subsidy decline as the conditional probability of conflict increases? The reason is that it is precisely when bargaining succeeds that bargaining power matters. As the probability of bargaining failure increases, the value of bargaining power decreases. Since the optimal subsidy compensates for a missing market for bargaining power, it declines as the value of bargaining power decreases.

The Likelihood of War and the National Security Externality The bargaining approach suggests one must be careful making arguments about the value of national security policy based on the probability of conflict. The approach highlights that the probability of conflict is an endogenous outcome. If one thinks conflict is unlikely for some country, one needs to ask what concessions it had to make to ensure this.[10] What was the price of the peace? A low probability does not imply that there is little need for national security policy; equation (31) actually suggests the opposite.

2.5.2 Arms, Influence, and Resilience

This paper has studied resilience as a source of bargaining power. A more often emphasized source of bargaining power is military power. One of the key insights in Schelling (1966) is that arms are valuable because they produce influence in bargaining. The model developed here does not capture this since the benefit of military production was not modeled. This section models the benefits of military power explicitly.

A Gun and Butter Model I now extend the basic setup by modeling the benefit of military production through a contest function, as in the standard guns-and-butter models.[11] The contest function takes defense production $d_1^{i,C}$ as an input and determines the split of the bargaining good during

[10] This point may be particularly relevant in the context of European dependency on Russian gas. Sometimes Germany's dependence on Russian gas was justified by pointing out that even during the height of the Cold War, the gas kept flowing. This argument fails to ask what Germany had to give up to ensure it did.

[11] Contest functions have been used to study conflict as an economic activity by Hirshleifer (1991) and Skaperdas (1992), among others.

conflict. The simple contest function used here is

$$B^{S,C} = B_{sq}^{S,P} + h(d_1^{S,C}) - h(d_1^{A,C})$$

where $d_1^{A,C}$ is exogenous and $h(.)$ is increasing and strictly concave. Sovereign can commit to a defense production before bargaining and is allowed to condition it on z.

The resulting setup differs slightly from standard guns-and-butter models. In standard guns-and-butter models, it is often assumed that output in the defense sector can only be used for defense and is thus wasted during peace. This means that stage 3 welfare is simply given by capital in sector 0,

$$V^{S,z} = \bar{k}^S - k_1^S.$$

This implies that an increase in k_1^S reduces $V^{S,P}$ and $V^{S,C}$ by an equal amount, thereby leaving resilience unaffected. The assumption that good 1 can also be consumed introduces an opportunity cost that allows investment in the defense sector to affect resilience.

Optimal Investment Subsidies The planning problem is presented in Appendix A.2. The optimal investment subsidy is unchanged and given by (25). The reason is that subsidies were derived for a given amount of defense output. The gun and butter model simply gives a microfoundation for optimal defense output during conflict.

The gun and butter model is often interpreted as a model that captures why countries want to invest in military power. Once defense is modeled as investment in the potential output of defense equipment rather than realized output, the role of investment is to increase resilience rather than military output. The key assumption is that defense production can move independently from capital investment. In this section, consumption can be sacrificed for more defense output, but the assumption that output is produced using both capital and labor would have the same implication.

3. The national security externality in a more general economy

The previous section discussed the national security externality in a simple economy. This setup is too stylized to develop many of the interesting implications of the national security externality for policy. The economy is therefore generalized along two margins. First, the domestic economy is enriched to allow for a more general production structure and more general conflict shocks. Second, the economy is enriched to allow for international trade.

3.1 A more general economy

Generalized the domestic economy The economy is generalized along several dimensions. There are additional $\ell \in \mathcal{L}$ factors of production, referred to as labor, that are endowed and hence not chosen before the bargaining stage. Additionally, capital is no longer sector-specific; instead, there is investment to create $f \in \mathcal{F}$, specialized varieties of capital that can be allocated to $g \in \mathcal{G}$ goods. The assumption that capital is produced through a linear technology is also relaxed. There is production of commodities by means of commodities, in addition to factors. Lastly, the state of geopolitics can affect preferences and technologies directly.

International trade There is now trade between countries. To allow for international substitution, Sovereign is assumed to trade with multiple partners denoted by $j \in \mathcal{J}$. This set includes Adversary as well as neutral countries. These neutral countries do not engage in any policy actions or bargaining. The structure of their domestic economies is identical to that of Sovereign and Adversary. To keep things simple, it is assumed that the countries in $\mathcal{J}$ do not trade among themselves but only engage in trade with Sovereign. This implies that Sovereign can influence Adversary's resilience only by directly manipulating its trade with Adversary, rather than indirectly by altering trade with neutral countries.

Preferences Consumers now consume a vector $g \in \mathcal{G}$ and their preferences can be affected by z directly,

$$U^{i,z} = B^{i,z} + u^{i,z}(\mathbf{c}^{i,z})$$

where $\mathbf{c}^{i,z} = \{c_g^{i,z}\}$. By allowing z to enter preferences directly, the model can capture demand shifts and social costs caused by conflict.

Technologies The production technology for sector g is given by:

$$y_g^{i,z} = F_g^{i,z}(\mathbf{k}_g^{i,z}, \mathbf{l}_g^{i,z}, \mathbf{m}_g^{i,z}). \tag{32}$$

The inputs are vectors of specialized capital $\mathbf{k}_g^{i,z} = \{k_{gf}^{i,z}\}$, labor $\mathbf{l}_g^{i,z} = \{l_{g\ell}^{i,z}\}$, and intermediate goods $\mathbf{m}_g^{i,z} = \{m_{gh}^{i,z}\}$. The technology can depend on z. This allows the model to capture various forms of wartime destruction and disruption that can be thought of as technology shocks.

The technology that transforms the initial capital endowment into varieties is no longer linear; it is now denoted by

$$G(\bar{\mathbf{k}}^i) \leq \bar{k}^i \tag{33}$$

where $\bar{\mathbf{k}}^i = \{\bar{k}_f^i\}$ is the supply of capital during stage 3.

Market clearing conditions We use i to refer to all countries. The goods market clearing condition is generalized to allow for trade, namely,

$$y_g^{i,z} = c_g^{i,z} + x_g^{i,z} + \sum_{h \in \mathcal{G}} m_{hg}^{i,z} \quad \text{where} \quad x_g^{S,z} = \sum_{j \in \mathcal{J}} x_g^{Sj,z}. \tag{34}$$

The capital market clearing condition for each specialized variety of capital $f \in \mathcal{F}$ is given by:

$$\sum_{g \in \mathcal{G}} k_{gf}^{i,z} = \bar{k}_f^i. \tag{35}$$

The market clearing condition for labor $\ell \in \mathcal{L}$ is given by:

$$\sum_{g \in \mathcal{G}} l_{g\ell}^{i,z} = \bar{l}_\ell^i. \tag{36}$$

Since countries only trade with Sovereign, the international market clearing condition for each $j \in \mathcal{J}$ is:

$$x_g^{Sj,z} + x_g^{j,z} = 0. \tag{37}$$

Prices and trade policy Prices for Sovereign are related to international prices by sector-specific ad-valorem taxes $t_g^{Sj,z}$:

$$p_g^{S,z} = (1 + t_g^{Sj,z}) q_g^{j,z} \quad \text{and} \quad p_g^{j,z} = q_g^{j,z}. \tag{38}$$

Neutral countries and Adversary do not impose any trade taxes, hence their domestic prices equal international prices. The international budget constraints (trade balance) are:

$$\sum_{g \in \mathcal{G}} q_g^{j,z} x_g^{j,z} = 0 \quad \text{and} \quad \sum_{j \in \mathcal{J}} \sum_{g \in \mathcal{G}} q_g^{j,z} x_g^{Sj,z} = 0. \tag{39}$$

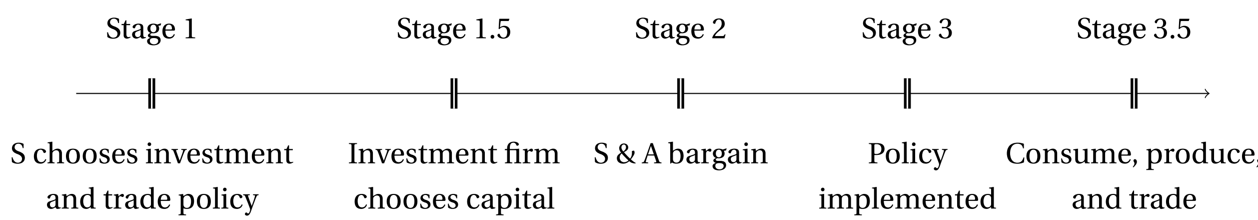
Equilibrium definition The decision problems of agents and other equilibrium conditions are similar to Section 2 can be found in Appendix **??**. The definition of competitive equilibrium now becomes

Definition 3 (Open economy competitive equilibrium with taxes)**.** *Given policies* $\{\mathbf{t}^{i,z}, \mathbf{s}^i\}$ *and outcomes of the bargaining game* z *and* $B^{i,z}$*, a competitive equilibrium consists of prices* $\{\mathbf{p}^{i,z}, \mathbf{r}^{i,z}, \mathbf{w}^{i,z}, \mathbf{q}^{i,z}\}$*, an allocation of factors* $\{\mathbf{k}^{i,z}, \bar{\mathbf{k}}^i, \mathbf{l}^{i,z}\}$*, consumption, production, and intermediate goods* $\{\mathbf{c}^{i,z}, \mathbf{y}^{i,z}, \mathbf{m}^{i,z}\}$*, a pattern of trade,* $\mathbf{x}^{i,z}$*, and a lump sum transfer,* $T^{i,z}$ *,that satisfy agent optimization, market clearing, the government budget constraints, and the trade balance conditions.*

Bargaining The bargaining setup is refined in two ways. First, while in the previous sections Sovereign took Adversary's quantities as given, it will now take its policies as given.[12] Second, the bargaining game is extended such that θ^S and θ^A no longer need to sum to one, meaning θ^S can be set to 0 without setting θ^A to one. This is useful to develop the different uses of trade policy later. This is done by introducing a probability the bargaining stage is skipped; details are found in Appendix B.2.

The timing is similar to the closed economy, but Sovereign chooses policies rather than quantities, and investment is chosen by the firm. It is assumed that Sovereign commits to both investment subsidies and trade taxes in stage 1. The timing is displayed in Figure 3.

Figure 3: Timing of the economy



3.2 Discussion

Generalizing the domestic economy This section generalizes the closed economy to allow for a more complex production structure and a wider range of conflict shocks. The more general production structure allows for a discussion of how investment policy should discriminate between different technologies that produce the same output. It also allows for a discussion of how the targeting of investment policy should depend on the economic fundamentals of a sector. The more general shocks allow the model to capture various types of conflict. For example, wartime destruction can be captured through technology shocks. Note that technology shocks can affect third countries — for instance, manufacturing capacity in Taiwan could be destroyed during a conflict between China and the US.

International trade and resilience This section generalizes the model to allow for international trade. It allows for a discussion of three aspects of trade. First, trade can be a source of conflict shocks. For example, the prices of capital goods may fluctuate if the U.S. is cut off from semiconductors during a conflict with China over Taiwan. This can generate a strategic rationale for reducing exposure to trade. Second, trade is a source of resilience because it allows for substitution

[12] In the closed economy it does not matter whether Sovereign takes quantities or policies as given. The assumption that it took quantities as given was expositionally useful but does not matter otherwise.

in response to shocks. For instance, both Russia and Ukraine rely on imports of defense equipment, easing the pressure on their domestic defense industrial base. This is why third countries were introduced — it can generate a strategic rationale for friendshoring. Third, trade can be used to hurt an adversary. This generates a rationale for weaponizing trade.

3.3 Planning Problem

The problem for Sovereign is to use policies to select the best competitive equilibrium, taking into account that the competitive equilibrium affects the bargaining outcomes. Let $\mathbf{c}^{i,z}(\mathbf{s}^S, \mathbf{t}^S)$ denote the consumption associated with a competitive equilibrium, indexed by policies $\mathbf{s}^S = \{s_f^S\}$ and $\mathbf{t}^S = \{t_g^{S,z}\}$. Welfare associated with a particular competitive equilibrium is then given by:

$$\begin{aligned} W^S(\mathbf{s}^S, \mathbf{t}^S) = u^{S,P}(\mathbf{c}^{S,P}(\mathbf{s}^S, \mathbf{t}^S)) + \theta^A \left(u^{S,C}(\mathbf{c}^{S,C}(\mathbf{s}^S, \mathbf{t}^S)) - u^{S,P}(\mathbf{c}^{S,P}(\mathbf{s}^S, \mathbf{t}^S)) \right) \\ - \theta^S \left(u^{A,C}(\mathbf{c}^{A,C}(\mathbf{s}^S, \mathbf{t}^S)) - u^{A,P}(\mathbf{c}^{A,P}(\mathbf{s}^S, \mathbf{t}^S)) \right) + B^{S,C} \end{aligned} \tag{40}$$

The problem for Sovereign is to choose allocations and policies that implement those allocations, subject to the constraints that the allocations and policies are consistent with the open economy competitive equilibrium and the bargaining outcomes.

Primal Problem To study the problem, I will focus on the primal formulation, where welfare is considered as a function of quantities (investment and trade) rather than policies. I begin by defining welfare during the third stage as a function of capital, now incorporating trade patterns, as

$$V^{i,z}(\bar{\mathbf{k}}^i, \mathbf{x}^{i,z}) \equiv \max u^{i,z}(\mathbf{c}^{i,z}) \qquad \text{subject to (32) and (34) –(36).} \tag{41}$$

As before, the competitive equilibrium, conditional on the allocation of capital and trade, is efficient. Hence, stage 3 welfare in a competitive equilibrium can be summarized by the pattern of trade and capital allocation induced by that equilibrium, such that

$$V^{i,z}(\bar{\mathbf{k}}^i(\mathbf{s}^S, \mathbf{t}^S), \mathbf{x}^{i,z}(\mathbf{s}^S, \mathbf{t}^S)) = u^{i,z}(\mathbf{c}^{i,z}(\mathbf{s}^S, \mathbf{t}^S)). \tag{42}$$

This setup introduces two new considerations. As can be seen from (41), welfare for any country depends on both capital and trade. In a competitive equilibrium, the allocation of capital will generally depend on the trade pattern. The capital allocation will, in turn, affect the demand for trade at a given price. This implies that Sovereign must monitor how its trade with a given partner influences capital investment, both because it can affect the terms of trade and, in the case of Adversary, its resilience to conflict.

Let $\bar{\mathbf{k}}^j(\mathbf{x}^{Sj,P})$ denote the capital stock in a country j that is consistent with its competitive equilibrium. Observe that it only depends on trade during peace, since conflict does not occur in equilibrium, and hence does not affect investment decisions. Let $q_g^{j,z}(\mathbf{x}^{Sj,z}, \bar{\mathbf{k}}^j(\mathbf{x}^{Sj,P}))$ denote international prices consistent with a competitive equilibrium. Note that prices during conflict will depend on trade during conflict and *trade during peace* through the capital stock. This implies that Sovereign can manipulate terms of trade during conflict by manipulating trade during peace.

The planning problem is now given by

$$\begin{aligned}
\max_{\bar{\mathbf{k}}^S, \mathbf{x}^{S,z}} \quad & V^{S,P}(\bar{\mathbf{k}}^S, \mathbf{x}^{S,P}) + \underbrace{\theta^A \left(V^{S,C}(\bar{\mathbf{k}}^S, \mathbf{x}^{S,C}) - V^{S,P}(\bar{\mathbf{k}}^S, \mathbf{x}^{S,P})\right)}_{\text{Domestic Resilience}} \\
& - \underbrace{\theta^S \left(V^{A,C}(-\mathbf{x}^{SA,C}, \bar{\mathbf{k}}^A(\mathbf{x}^{SA,P})) - V^{A,P}(-\mathbf{x}^{SA,P}, \bar{\mathbf{k}}^A(\mathbf{x}^{SA,P}))\right)}_{\text{Adversary's resilience}} + B^{S,C} \\
\text{subject to} \quad & G(\bar{\mathbf{k}}^S) \leq \bar{k}^S \\
& \sum_{g \in \mathcal{G}} q_g^{j,z}(\mathbf{x}^{Sj,z}, \bar{\mathbf{k}}^j(\mathbf{x}^{Sj,P})) x_g^{Sj,z} = 0 \quad \forall j \in \mathcal{J}.
\end{aligned}$$

A more detailed derivation of this planning problem is found in Appendix C.1.

3.4 Optimal Policy in the Absence of Bargaining

In the next two sections, we will see that the planning model above introduces various motives for adopting trade policy for national security purposes. Here, we briefly discuss the case without bargaining to clarify which considerations the bargaining model adds to trade policy and which would be present without it. Substituting $\theta^S = \theta^A = 0$ into the planning model yields:

$$\begin{aligned}
\max_{\bar{\mathbf{k}}^S, \mathbf{x}^{S,z}} \quad & V^{S,P}(\bar{\mathbf{k}}^S, \mathbf{x}^{S,P}) + B^{S,C} \\
\text{subject to} \quad & G(\bar{\mathbf{k}}^S) \leq \bar{k}^S \\
& \sum_{g \in \mathcal{G}} q^{j,z}(\mathbf{x}^{Sj,z}, \bar{\mathbf{k}}^j(\mathbf{x}^{Sj,P})) x_g^{Sj,z} = 0 \quad \forall j \in \mathcal{J}.
\end{aligned}$$

Optimal policy Before describing optimal policy, we define $\mathcal{E}_g^{Sj,z_1,z_2}$ as the total terms of trade effect in state z_1 for Sovereign, from changing trade with j in state z_2:

$$\mathcal{E}_g^{Sj,z_1,z_2} \equiv \sum_{h \in \mathcal{G}} \frac{\mathrm{d}q_h^{j,z_1}}{\mathrm{d}x_g^{Sj,z_2}} \frac{x_h^{Sj,z_1}}{q_g^{j,z_2}} \tag{43}$$

It reflects how much changes in x_g^{Sj,z_2} relax the trade balance condition evaluated at the current trading pattern. The subtlety in this expression is that trade during peace generally has terms of trade effects during conflict because of adjustments to the trading partner's capital stock. Taking the first-order conditions of the planning problem and using the households' first-order conditions to express them in terms of prices leads to the following proposition.

Proposition 2 (Optimal Terms of Trade Manipulation in the Absence of Bargaining)**.** *Trade taxes during peace are given by*

$$t_g^{Sj,P} = \mathcal{E}_g^{Sj,PP} \tag{44}$$

investment subsidies and trade taxes during conflict are not necessary.

When bargaining is shut down, the model generates the standard expression for optimal terms of trade manipulation. The proposition does not provide an expression for optimal taxes during conflict because conflict does not occur in equilibrium and countries do not otherwise value it.

4. Policy to Increase Domestic Resilience

This section studies the use of investment subsidies and trade taxes to enhance domestic resilience. Section 4.1 provides a general characterization of optimal investment subsidies and trade policy. Section 4.2 discusses three implications of the investment subsidy expression for national security policy. Section 4.3 discusses the interpretation of the trade policy result as a form of friendshoring and explains why trade policy is not used to protect domestic capacity.

4.1 Optimal National Security Policy to Support Domestic Resilience

Sovereign can use trade taxes to increase domestic resilience to conflict but can also use them to hurt Adversary. In order to isolate the motive to use trade policy in support of domestic resilience, this section studies the case where $\theta^S = 0$ and $\theta^A > 0$. The planning problem of interest is given by:

$$\begin{aligned} \max_{\bar{\mathbf{k}}^S, \mathbf{x}^{S,z}} \quad & V^{S,P}(\bar{\mathbf{k}}^S, \mathbf{x}^{S,P}) + \theta^A \left(V^{S,C}(\bar{\mathbf{k}}^S, \mathbf{x}^{S,C}) - V^{S,P}(\bar{\mathbf{k}}^S, \mathbf{x}^{S,P}) \right) + B^{S,C} \\ \text{subject to} \quad & G(\bar{\mathbf{k}}^S) \leq \bar{k}^S \\ & \sum_{g \in \mathcal{G}} q^{j,z}(\mathbf{x}^{Sj,z}, \bar{\mathbf{k}}^j(\mathbf{x}^{Sj,P})) x_g^{Sj,z} = 0 \quad \forall j \in \mathcal{J} \end{aligned}$$

For expositional purposes, it is useful to present the propositions for the case when good 0 is a natural numeraire good.

Definition 4 (Natural numeraire good)**.** *Good 0 is a natural numeraire good when the marginal utility of consumption is unity for all countries and changes in the pattern of trade for this good have no terms-of-trade effects and do not affect the allocation of capital.*

The next proposition characterizes the optimal policy resulting from this planning problem.

Proposition 3 (Policy and Domestic Resilience)**.** *Suppose that good 0 is a natural numeraire good. Then optimal investment subsidies are given by*

$$s_f^S = \theta^A \left(\frac{\bar{r}_f^{S,C}}{\bar{r}_f^{S,P}} - 1 \right), \tag{45}$$

optimal trade taxes during conflict are given by

$$t_g^{Sj,C} = \mathcal{E}_g^{Sj,CC} \tag{46}$$

and optimal taxes during peace are given by

$$t_g^{Sj,P} = \frac{1}{1-\theta^A} \left(\mathcal{E}_g^{Sj,PP} + \theta^A \left(\mathcal{E}_g^{SA,PC} - \mathcal{E}_g^{SA,PP} \right) \right), \tag{47}$$

where $\bar{r}_f^{S,z} \equiv \lambda^{S,z} r_f^{S,z}$ is the price of capital used by the investment firm. The multiplier corrects for changes in the marginal utility of income. For the quasi-linear case, it does not change between states of geopolitics. The proof is given in Appendix C.4. The proof is provided for both the general and quasi-linear cases. The general case does not add substantive economic forces.

The reason (45) is almost unchanged compared to the closed economy case is that trade did not introduce additional distortions that are best targeted by investment subsidies. The richer model admits essentially the same sufficient statistic for optimal subsidies because the price of capital goods still reflects the social marginal value of capital.

Optimal trade taxes during conflict simply maximize terms-of-trade gains. These taxes maximize welfare (excluding $B^{S,z}$) during conflict and thereby maximize resilience. Trade taxes during peace are more interesting. They deviate from terms-of-trade maximization during peace by also taking terms-of-trade gains during conflict into account. Trade during peace affects the capital stock in other countries and can thereby generate terms-of-trade benefits during conflict.

4.2 Investment Policy in the Open Economy

This section discusses three implications of the optimal investment subsidy. Section 4.2.1 shows that optimal investment subsidies can be used to reshore production, i.e., investment subsidies lean against the pattern of trade. Section 4.2.2 examines features of an industry that make reshoring particularly advantageous. Section 4.2.3 shows that subsidies may encourage the capacity to substitute.

4.2.1 Reshoring

Countries across the world are considering bringing production back home in order to raise resilience to trade conflict. The national security externality can rationalize this as optimal policy when countries bargain in the shadow of a conflict that disrupts trade.

To see this, consider the case where Sovereign is a small open economy that only trades with Adversary. This means it takes $q_g^{SA,z}$ as given. Each good is produced using a single sector-specific capital good, $y_g^{i,z} = f_g^i(k_g^{i,z})$. In this case, the first-order condition of the firm yields

$$q_g^{SA,z} \frac{\partial f_g^S(k_g^S)}{\partial k_g^S} = r_g^{S,z}.$$

This implies that optimal subsidies satisfy:

$$s_g^S = \theta^A \left(\frac{q_g^{SA,C}}{q_g^{SA,P}} - 1 \right). \tag{48}$$

Whether policy leans against the pattern of trade depends on how $q_g^{SA,z}$ relates to the pattern of trade. The natural case for when countries bargain in the shadow of a trade conflict is that the price of output rises in sectors in which net imports are high and falls for those where exports are high. That is, price movements caused by a trade conflict naturally covary negatively with net imports. In this case, it follows from equation (48) that

$$\text{if} \quad \text{cov}\left(x_g^{SA,P}, \frac{q_g^{SA,C}}{q_g^{SA,P}} - 1 \right) > 0 \quad \text{then} \quad \text{cov}(x_g^{SA,P}, s_g^S) > 0. \tag{49}$$

This is how investment subsidies can be used to reshore production. If a conflict has a significant trade component—leading capital good prices to rise in sectors with high net imports and to fall in those with high net exports—then subsidies may encourage bringing productive capacity back home.

4.2.2 When Is a Sector a Priority for Reshoring?

This section uses an example to discuss the targeting of investment subsidies that reshore capacity in more detail. The general principle is that subsidies target those sectors where the demand shifts outward during conflict and is relatively inelastic. This section effectively relates the shape of the capital demand curve to the features of the sectors it is employed in.

Demand Sovereign has quasi-linear preferences over a numeraire good and final goods. Final goods are an aggregate of domestic varieties with an aggregated bundle of foreign varieties. The utility functions and aggregators are respectively given by

$$u^{S,z} = c_0^{S,z} + \sum_{g \in \mathcal{G}/0} \frac{\left(c_g^{S,z}\right)^{1-\frac{1}{\sigma_g}}}{1-\frac{1}{\sigma_g}}, \quad c_g^{S,z} = \left(c_{Sg}^{S,z}\right)^{\alpha_{Sg}} \left(c_{\mathcal{J}g}^{S,z}\right)^{\alpha_{Jg}} \quad \text{and} \quad c_{\mathcal{J}g}^{S,z} = \left(\sum_{j \in \mathcal{J}} \beta_{jg}^{S} \left(c_{jg}^{S,z}\right)^{\frac{\epsilon_g-1}{\epsilon_g}}\right)^{\frac{\epsilon_g}{\epsilon_g-1}}$$

where $\alpha_{Sg} + \alpha_{\mathcal{J}g} = 1$ and $\epsilon_g > 1$.

Supply Output of a domestic variety is linear in the capital employed in that sector, $y_g^{S,z} = k_g^{S,z}$. Since demand for good 0 is linear, this implies the supply of domestic output is perfectly elastic for all other goods. Foreign goods are available at constant prices but change with z.

Conflict shocks To obtain sharp expressions, the example studies shocks that disrupt trade to such an extent that Sovereign is completely cut off from a subset of trading partners, denoted by $\mathcal{J}_D$, i.e., $q_{jg}^{S,C} \to \infty$ for $j \in \mathcal{J}_D$. An example of such a shock would be a Chinese blockade or bombardment of Taiwan, which would mean the U.S. gets cut off from semiconductors.

The derived demand for capital The supply of capital is fixed in the short run, so the change in prices will be determined by the shift in demand for capital and the movement along it. Let DS_g^S denote the log-change in $\hat{k}_g^S = \frac{k_g^{S,C}}{k_g^{S,P}}$, when keeping capital prices fixed. Let $EFDF_g^S$ denote the elasticity of derived factor demand, computed as the log-change in $\hat{k}_g^S$ in response to a change in the price of capital. Suppose we use χ_{jg}^S to denote the share of imports coming from j. Then, the change in capital prices can be written as:

$$\frac{r_g^{S,C}}{r_g^{S,P}} - 1 \approx \ln(\hat{r}_g^S) = -\frac{DS_g^S}{EFDF_g^S} = \frac{(1-\sigma_g)\alpha_{\mathcal{J}g} \ln \hat{P}_{\mathcal{J}g}^S}{1-\alpha_{Sg}(1-\sigma_g)},$$

$$\text{where} \quad \ln \hat{P}_{\mathcal{J}g}^S = \frac{1}{1-\epsilon_g} \ln\left(1 - \sum_{j \in \mathcal{J}_D} \chi_{jg}^S\right)$$

where the first approximation is accurate around $\hat{r}_g^S = 1$ and where hat-variables denote the ratio between conflict and peace states. The derivation assumes that the trade elasticity ϵ_g is greater than one. The derivation is found in Appendix D.2.

Implications The example provides a simple rationale for why the United States may want to target a sector such as semiconductors. To the extent it is indeed a critical good, it would have a low elasticity of demand $\sigma_g < 1$. The demand for capital inherits this low elasticity. It also implies demand for capital shifts outwards. The most advanced semiconductors are in large part imported from Taiwan, which is prone to a conflict between the U.S. and China. This implies that $\alpha_{\mathcal{J}g}$ and $\sum_{j\in\mathcal{J}_D} \chi^S_{jg}$ are both high. Lastly, because it is an advanced manufactured good, it is hard to substitute elsewhere, suggesting that ϵ_g is relatively low.[13] Note that the effect of large shocks is extremely non-linear in the import shares. It can become arbitrarily large as the total import share of the exposed countries approaches one.

4.2.3 Investment in the Capacity to Substitute

Suppose that countries have access to two technologies that produce the same thing. This section shows that subsidies encourage investment in the technology that allows a country to adjust.

Investment in the ability to switch suppliers Consider the following example of an investment in the capacity to adjust — the capacity to substitute to another supplier. Suppose Germany can import gas through either pipelines or LNG terminals. The difference between these technologies is that pipelines can only import from Russia, whereas terminals can import from both Russia and a neutral third party. Suppose that import prices from Russia rise during a conflict. Which technology should be subsidized more? We will see that there is an argument for subsidizing terminals over pipelines, *but only if the option to switch is exercised during conflict.*

Consider an economy with two final goods. Good 0 is a numeraire, while the other good is domestic gas. To obtain domestic gas, it must be imported, which requires domestic capital and foreign gas. Once gas is imported, it does not matter where it was obtained. Sovereign is a small open economy that takes foreign prices as given. Total gas consumption is given by:

$$c^{S,z}_{gas} = \sum_{g\in\{\text{term,pipe}\}} \left(k^{S,z}_g\right)^{\alpha v} \left(x^{S,z}_g\right)^{(1-\alpha)v}$$

where $v < 1$ introduces some concavity, ensuring that both technologies are used.[14]

Gas imported via pipelines must come from the adversary, $x^{S,z}_{pipe} = x^{SA,z}_{pipe}$. Gas imported through terminals can come from both trading partners, $x^{S,z}_{term} = x^{SA,z}_{term} + x^{Sn,z}_{term}$. Each technology will always

[13] Broda and Weinstein (2006) estimate trade elasticities for different products. They show that trade elasticities for commodities are higher than for other more differentiated products.

[14] For pipelines, an import technology with a lower elasticity of substitution may be more realistic. This case is developed in Appendix D.1. The derivation of the Cobb-Douglas case can also be found there.

import from the lowest-cost supplier. With a slight abuse of notation, this implies that $q^{S,z}_{pipe} = q^{SA,z}_{gas}$ and $q^{S,z}_{term} = \min\{q^{SA,z}_{gas}, q^{Sn,z}_{gas}\}$.

Prices for capital goods can then be solved as:

$$\hat{r}^S_g = \hat{p}^S_{gas} \left(\hat{x}^S_g\right)^{(1-\alpha)v} = \hat{p}^S_{gas} \left(\frac{\hat{p}^S_{gas}}{\hat{q}^S_g}\right)^{\frac{(1-\alpha)v}{1-(1-\alpha)v}}, \tag{50}$$

where hat notation denotes the ratio of conflict to peace. The optimal subsidy is then given by equation (45).

The case of interest is when the adversary is the cheaper supplier during peace but becomes the more expensive one during conflict. In this scenario, the option to switch suppliers is utilized during the conflict equilibrium. This implies that $\hat{q}^S_{pipe} > \hat{q}^S_{term}$ and, therefore, $\hat{r}^S_{term} > \hat{r}^S_{pipe}$. Optimal policy subsidizes the technology that allows for more substitution, but interestingly, only if that option is exercised during conflict. This is the case when Sovereign switches inputs and the marginal product of terminals rises above that of pipelines.

Investment in scalable technologies Another way to invest in the ability to adjust is to produce using technologies that can scale during conflict. Murphy and Topel (2013) point out that conflicts are rare, so it is efficient to invest in capacity that can scale up during conflict rather than produce more at all times.[15] This logic extends to the case where conflict never happens but there is a strategic value in being resilient to it due to the national security externality.

The economy is similar to Section 2: utility is quasi-linear, and during conflict the demand for good 1 increases. The difference is that good 1 can now be produced through technologies 2 and 3, which use both capital and labor.

$$c^{S,z}_1 = \left(k^{S,z}_2\right)^{(1-\alpha_2)v} \left(l^{S,z}_2\right)^{\alpha_2 v} + \left(k^{S,z}_3\right)^{(1-\alpha_3)v} \left(l^{S,z}_3\right)^{\alpha_3 v} \tag{51}$$

Here, $v < 1$, which means there are decreasing returns, and both technologies are used in equilibrium. The parameter α_g captures the scalability of the technology.[16] We assume that $\alpha_2 > \alpha_3$, meaning that technology 2 is more scalable ex-post. We will see this implies that $s^S_2 > s^S_3$.

[15]Murphy and Topel (2013) are not the first to make this type of argument. Smith (1776) makes a similar argument when discussing the merits of a militia versus a standing army. Smith argues that a key advantage of a militia is that members can return to their occupations when the war is over. However, Smith prefers a standing army, arguing that the benefits of the specialization of labor outweigh the higher costs of a standing army.

[16]To see why α_g is related to the scalability of the technology, we compute the short-run output (with fixed capital) response to an increase in price. The output elasticity with respect to prices is given by: $\frac{d \ln y^S_g}{d \ln p^S_1} = \frac{\alpha_g v}{1-\alpha_g v}$. This elasticity equals zero when capital is the only input and increases as α_g rises. A higher α_g indicates that the technology is more scalable in equilibrium because it has a higher output elasticity for an input that can be increased without driving up its price.

To solve for the optimal subsidy, we take the first-order conditions for both technologies.[17] By combining and rearranging them, we obtain an expression for changes in capital goods prices:

$$\frac{r_g^{S,C}}{r_g^{S,P}} = \frac{p_1^{S,C}}{p_1^{S,P}} \left(\frac{l_g^{S,C}}{l_g^{S,P}}\right)^{\alpha_g v} = \frac{p_1^{S,C}}{p_1^{S,P}} \left(\frac{p_1^{S,C}}{p_1^{S,P}}\right)^{\frac{\alpha_g v}{1-\alpha_g v}} = \left(\frac{p_1^{S,C}}{p_1^{S,P}}\right)^{\frac{1}{1-\alpha_g v}}. \tag{52}$$

The optimal subsidy is then found by substituting this expression into (45). It follows immediately that subsidies are increasing in α_g. The reason is, again, that the marginal product of capital co-moves more strongly with conflict when the ability to adjust is larger.

The first step in (52) shows that even if the increase in labor between the two technologies were identical, the price of more scalable capital would rise more. The second step shows that labor tends to move toward the technologies where its marginal product declines more slowly, leading to a "multiplier effect" given by $\frac{1}{1-\alpha_g v}$, which favors the scalable technology. The final step rearranges the terms, leading to the conclusion that optimal subsidies target the more scalable technology, provided that output prices in that sector rise.

4.3 Domestic Resilience and Trade Policy

This section develops two implications for trade policy from Proposition 3. First, trade policy is used to manipulate the capital stock in third countries. Second, trade policy is not used to protect domestic industry. This is the role of industrial policy.

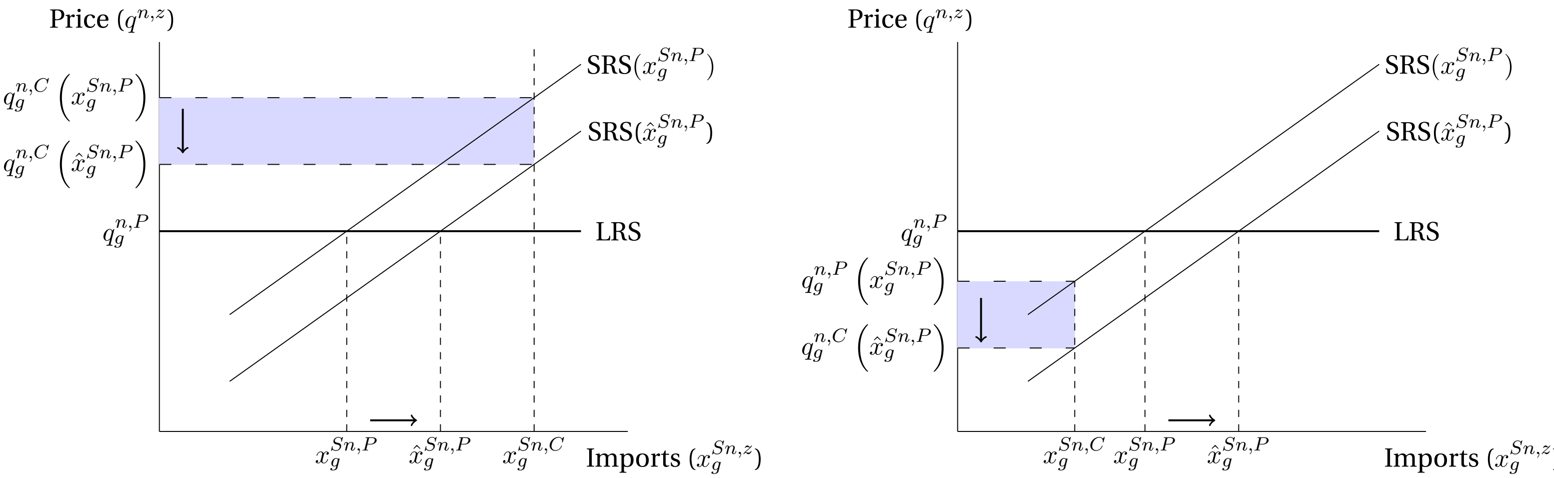
4.3.1 An Interpretation of Friendshoring as Terms-of-Trade Manipulation

Trade can be a source of exposure to conflict, but it can also provide resilience by allowing countries to absorb shocks through increased imports from trading partners. One interesting question is whether trade policy can be used to enhance this resilience. An interpretation of the cross-state-of-politics terms-of-trade term, in equation (47), is that it attempts to do exactly that.

For concreteness, suppose that the United States bargains with China and anticipates that, during conflict, it will lose access to Taiwanese semiconductors. As a result, it will attempt to increase imports from South Korea during conflict relative to peace. The question is whether this conflict scenario introduces a rationale to preemptively increase demand from South Korea during peace as well. The argument for why the answer may be yes is illustrated in Figure 4.

[17] These are given by $r_g^{S,z} = p_1^{S,z}(1-\alpha_g)v\left(k_g^S\right)^{(1-\alpha_g)v-1}\left(l_g^{S,z}\right)^{\alpha_g v}$ for capital and $1 = p_1^{S,z}\alpha_g v\left(k_g^S\right)^{(1-\alpha_g)v}\left(l_g^{S,z}\right)^{\alpha_g v-1}$ for labor.

Figure 4: The argument for preemptively increasing imports



(a) Gains when imports rise during conflict

(b) Gains when imports fall during conflict

Figure 4 uses the observation that trade during peace moves along the long-run supply function, whereas trade during conflict moves along the short-run supply function. By increasing imports during peace, Sovereign can induce investors in neutral countries to increase their capital stock. This results in an outward shift of the short-run supply function. In turn, this lowers the cost of importing a given quantity of goods, as demand during conflict, $x_g^{Sn,C}$, intersects the short-run supply curve at a lower point.

The figure illustrates that the argument applies whether imports rise or fall during conflict. The key point is that the value of terms-of-trade manipulation via the capital stock is larger when imports rise during conflict. This is due to a scale effect: the value of a price reduction is larger when a country is a bigger net buyer, all else being equal.

International coordination The objective of terms of friendshoring is to manipulate capital to obtain terms-of-trade gains during conflict. A more direct way to obtain income gains during conflict is to agree with other countries to transfer resources during a conflict. Kooi (2024) studies an economic security union—an arrangement where countries form a fiscal union and commit to providing such transfers directly in case of conflict. When there is limited commitment, countries may want to coordinate industrial policy to increase the ability to commit to such transfers.

4.3.2 Why the National Security Exemption to Laissez-Faire Does Not Apply Here

There is a classic argument that states should restrict trade for national security reasons. This argument goes back at least to the 18th century, when it was made by Smith (1776), who defended the Navigation Acts by pointing to the national security benefits: "The defense of Great Britain, for example, depends very much upon the number of its sailors and shipping... As defense, however, is of much more importance than opulence, the act of navigation is, perhaps, the wisest of all the commercial regulations of England."[18]

This type of argument is still often heard today. The core of the argument is that imports crowd out domestic production capacity, and this is somehow bad, for reasons related to national defense or concerns about dependency. Economists often dismiss these types of arguments by pointing to the benefits of free trade. However, this is an unsatisfactory response since it does not engage with the premise of the argument. Even Adam Smith acknowledges there are losses to "opulence" but argues that the national security benefits outweigh the costs.

This paper acknowledges both forces: the stock of capital responds to trade patterns, and bargaining can explain why dependency may be undesirable. Yet, the argument fails even on its own terms. The reason is that dependency is not destiny. The link between trade and dependency is intermediated by investment, and policy can intervene directly at that stage through investment subsidies. Policy should pay for what it wants to buy. If a country desires more productive capacity in a particular sector, the efficient way to achieve this is through investment subsidies.

To see how this follows from the proposition, consider the case in which Sovereign is a small open economy. By this, I mean it takes $q_g^{Sj,z}$ as exogenous. This means that trade policy cannot be used to affect foreign prices, and hence its only potential role is to affect domestic allocations. Substituting $\mathcal{E}_g^{Sj,z_1,z_2} = 0$ into proposition 3 yields:

Corollary 1 (Trade taxes for a small open economy)**.** *Optimal trade taxes are zero for a small open economy:*

$$t_g^{Sj,z} = 0. \tag{53}$$

This argument has some interesting practical implications. For example, Germany should not reduce its dependency on Russian gas by directly targeting gas imports. Instead, it should consider taxing investment in capital that relies on cheap gas imports. Similarly, the EU should not tax Chinese solar panels but should rather subsidize their own production if it aims to reduce dependency. The reason is simple: cheap imports are not the problem - cheap is good. The core issue

[18] Smith discussed the Navigation Acts, which regulated shipping and trade in England by prohibiting foreign ships and limiting the employment of non-British sailors. Similar regulations exist in the United States today under the Jones Act, a federal law that restricts the transportation of cargo between U.S. ports to U.S.-built and U.S.-crewed ships. Like the Navigation Acts, the Jones Act is justified on national security grounds to support the U.S. maritime industry.

is the reduction of resilience caused by the dependency arising from the import-driven crowd out of the industrial base. Investment subsidies target this capacity directly and do not distort trade conditional on the allocation of capital.

5. Policy to Reduce an Adversary's Resilience

This section examines how Sovereign can weaponize trade to weaken Adversary's bargaining position. Sovereign achieves this by reducing Adversary's resilience to conflict. To analyze this role of trade policy, we refer to the full model where $\theta^A > 0$ and $\theta^S > 0$. The next proposition presents the optimal set of instruments for the full model. Since the case of $\theta^S = 0$ has already been covered, the new applications of trade policy are driven by the objective of reducing Adversary's resilience.

Proposition 4 (Optimal taxes against Adversary when $\theta^S > 0$)**.** *Suppose good 0 is a natural numeraire good then trade taxes against Adversary during conflict are given by*

$$t_g^{SA,C} = \left(1 + \frac{\theta^S}{\theta^A}\right) \mathcal{E}_g^{SA,CC}. \tag{54}$$

and trade taxes during peace against Adversary are given by

$$\begin{aligned} t_g^{SA,P} = & \frac{1}{1-\theta^A} \left[\mathcal{E}_g^{SA,PP} + \theta^A \left(\mathcal{E}_g^{SA,PC} - \mathcal{E}_g^{SA,PP}\right)\right] \\ & + \frac{\theta^S}{1-\theta^A} \left[\left(\mathcal{E}_g^{SA,PC} - \mathcal{E}_g^{SA,PP}\right) + \sum_{f \in \mathcal{F}} \left[\frac{\bar{r}_f^{S,C}}{\bar{r}_f^{S,P}} - 1\right] \rho_{fg}^{SA} \frac{r_f^{A,P} \bar{k}_f^A}{q_g^{A,P} x_g^{SA,P}}\right] \end{aligned} \tag{55}$$

where $\rho_{fg}^{SA} = \frac{\partial \bar{k}_f^A}{\partial x_g^{SA,P}} \frac{x_g^{SA,P}}{\bar{k}_f^A}$. The proof is in Appendix C.5. The proof is given for both the case when good 0 is a natural numeraire good and the general case when it is not. The general case does not introduce substantive additional considerations for optimal policy.

Sanctions Sovereign uses trade policy during conflict to reduce Adversary's resilience by driving down welfare during conflict. This punitive use of trade policy resembles sanctions. The standard terms-of-trade maximizing taxes are given by (54) when $\theta^S = 0$. To understand the rationale for such taxes, consider starting at the terms-of-trade maximizing level. This means a small increase in trade taxes does not have a first-order effect on welfare from consumption. However, it does affect Adversary's welfare. As Sovereign increases the tax further, there is a first-order cost on the consumption component of welfare, and the expression balances the two forces.[19]

[19] The role of sanctions here is to strengthen a country in negotiations with an adversary. The shape of the resulting objective function means that countries maximize some weighted average of their own welfare and that of their adver-

The expression for sanctions here is not generally time consistent. The reason is that once Sovereign enters the conflict state, it would be tempted to simply maximize terms-of-trade gains.[20]

Terms of Trade Manipulation During Peace One of the uses of trade during peace is to reduce Adversary's resilience by moving terms of trade in its favor during peace and against it during conflict. This motive is captured by the $\mathcal{E}_g^{SA,PP} - \mathcal{E}_g^{SA,PC}$ term.

Consider for a moment the case where $\theta^A = 0$ and there is no capital. In this case, optimal trade taxes are $t_g^{SA,P} = (1 - \theta^S)\mathcal{E}_g^{SA,PP}$, which is below the terms-of-trade maximizing level. By not maximizing terms of trade, Sovereign makes peace more appealing to Adversary, reducing its resilience. This introduces one force that may cause Sovereign to capture more rather than less of the gains from trade in a world where they bargain in the shadow of conflict.

The $\mathcal{E}_g^{SA,PC}$ term was previously used as an example of the motive to friendshore production. There is now an additional motive to manipulate terms of trade. One may also want to foreshore production. This is intuitive: if terms of trade move in favor of Sovereign, they must move against Adversary. This raises Sovereign's resilience and reduces that of Adversary; these forces are respectively captured by the θ^A and θ^S terms.

As an example, consider the motive for Russia to sell gas cheaply during peace to induce German firms to invest capital in the energy-intensive sector. Suppose that during a trade conflict, Russia cuts Germany off from some gas. This would generally have different terms-of-trade effects depending on the allocation of capital. Why would Russia value these terms-of-trade effects? First, if they go in its favor, they make Russia more resilient to conflict. Second, any terms-of-trade benefits for Russia come at the expense of Germany, driving up the cost of conflict for Germany, which also benefits Russia.

Reverse Industrial Policy The last term in equation (55) reflects the incentive to manipulate Adversary's resilience by manipulating its capital stock. It mirrors the same incentive that Sovereign has to manage its own capital stock. Optimal trade policy aims to pull capital out of sectors where it is relatively valuable during conflict and push it into sectors where it is not.

The specific sectors where conflict makes capital less valuable depend, as we have seen, on the

saries. Previous works have found similar expressions, as seen in Osgood (1957) and Sturm (2022). Osgood derives the value of hurting another from a desire to reduce its military power, while Sturm takes it simply as part of a country's preferences. Sturm shows that this expression has several interesting implications for sanctions design. One particularly relevant point is that sanctions, conditional on θ^S, do not depend on any feature of Sovereign's economy, but only on those of Adversary. For example, sanctions would not exempt natural gas imports even if they are critical to the domestic economy.

[20]The commitment assumption here is made primarily for expositional purposes, so that policy instruments match closely with their strategic objectives. If one wanted to take the assumption seriously, one would point out that the model is stacked in favor of time-inconsistency. In practice, countries bargain with several adversaries at once, which may introduce reputational value for following through. Another force could come from allies who might value the sanctions being implemented and apply pressure on each other to follow through.

type of conflict shock. For example, if conflict takes the form of war and the prices of capital goods in the defense sector appreciate, it may be optimal to sell weapons or weapon components to an adversary to crowd out investment in their industrial base. There is some evidence suggesting that Russian defense production was harmed because it relied on foreign components that were subsequently sanctioned.[21] Another example might involve an endogenous reduction in gas exports. Russia may want to sell gas cheaply to Germany to induce the development of energy-intensive industries, the capital in which may be of little value once gas imports decline during conflict.

6. Quantitative Conflict Scenario Analysis: The Conflict Over Taiwan

This section uses the theory developed so far to study the value of installing additional capital in various sectors to improve resilience to a potential conflict over Taiwan with China. I first briefly discuss my interpretation of how the theory suggests approaching this problem and then conduct my analysis.

6.1 A Few Remarks Before Quantification

What if? One of the most interesting features of the theory developed so far is the importance of the counterfactual in the argument for various policies. Targeting investment subsidies requires strategists to predict how prices would change in response to a conflict. Of course, other policy questions also require a counterfactual, but usually with respect to the policy itself. For example, optimal unemployment benefits depend on the elasticity of employment with respect to benefits. In the setting here, optimal subsidies depend on the counterfactual effect of conflict. Interestingly, measuring the effect of investment subsidies on observed outcomes during peace is not directly relevant to the decision at hand.

Quantifying the Sufficient Statistic The expression for optimal subsidies involves a simple sufficient statistic based on capital good prices. One's immediate intuition might be to look for a quasi-experiment and measure it. However, I find this approach unappealing for studying great power conflict because of difficulties related to external validity. For instance, to study a large-scale war in the Pacific, one would have to look back to World War II—a time when a sector like semiconductors did not exist. This lack of external validity, in a sense, supports the prediction of the bargaining theory of conflict: bargaining is valuable because it helps avoid great power conflict, but this also makes measurement difficult.

[21] Bergmann et al. (2023) report that sanctions created shortages of higher-end foreign components, which harmed Russia's capacity to manufacture certain weapon systems.

For this reason, this paper adopts a quantitative approach. Instead of measuring the causal effect of conflict on prices directly, I calibrate a quantitative trade model and simulate the causal effect of a specific conflict shock on prices. The advantage of this approach is that it allows me to leverage contemporary data, though it also involves stronger assumptions, including taking a stance on the exact nature of the shock during conflict.

Dealing with Unknown Political Parameters A challenge in quantifying the optimal subsidy is that we do not know the political parameters θ^A and θ^S. This raises two difficulties. First, even if we know $\frac{r_g^{S,C}}{r_g^{S,P}}$, we still cannot determine the optimal subsidy. Second, the effect of a given shock on prices depends on the allocation where the shock is evaluated, and this allocation is influenced by the subsidy. Hence, we cannot compute $\frac{r_g^{S,C}}{r_g^{S,P}}$ to begin with.

My preferred solution to these two difficulties is to slightly change the question and not focus on optimal subsidies. Instead I ask: which sectors would benefit most from additional capital? This deals with the second issue because it is a question about a marginal change at some given allocation. It can be answered for any allocation, the quantitative exercise quantifies it for the allocation in the data. This question also deals with the first issue. It compares one sector to another. This can be done without knowing θ^A since it enters multiplicatively to the change in capital goods prices.

The Local Measure of Strategic Value To obtain a local measure of the value of additional capital in a sector, we ask: what is the increase in welfare from spending an additional dollar on a unit of capital in sector g, while keeping the price $\bar{r}_g^{S,P}$ fixed?[22] This implies that $\bar{r}_g^{S,P} d\bar{k}_g^S = 1$. The resulting change in welfare is given by:

$$dW^S = \frac{\partial V^{S,P}}{\partial \bar{k}_g^S} d\bar{k}_g^S + \theta^A \left(\frac{\partial V^{S,C}}{\partial \bar{k}_g^S} - \frac{\partial V^{S,P}}{\partial \bar{k}_g^S} \right) d\bar{k}_g^S \tag{56}$$

$$= \underbrace{1}_{\text{Neoclassical value}} + \underbrace{\theta^A \left(\frac{\bar{r}_g^{S,C}}{\bar{r}_g^{S,P}} - 1 \right)}_{\text{Strategic value}} \tag{57}$$

Section 6.4 will report the strategic value for the case where $\theta^A = 1$. It is standard in the sufficient statistics literature to ignore the possibility that the sufficient statistic changes as the policy changes. If one accepts this assumption then the reported strategic value can be interpreted as an upper bound on subsidies.

[22] This welfare change does not take into account the opportunity cost of this increase in expenditure. Other perturbations could be constructed in which investment in one sector is increased and investment in some weighted average of other sectors is decreased. Since one would be subtracting the same number for each perturbation this would not affect the rankings one obtains, though it would affect levels.

6.2 The Conflict Scenario

The conflict scenario studied here revolves around a potential conflict in the East China Sea. China considers Taiwan a renegade province, and its president has directed the People's Liberation Army to be prepared to invade Taiwan by 2027. The Taiwan Relations Act states that Congress views any efforts to determine Taiwan's future by means other than peaceful ones as a grave concern and commits the U.S. to maintaining the capacity to resist any force that would jeopardize Taiwan's security. Through the lens of the model, I interpret this situation as one in which the United States and China are bargaining over the political status of Taiwan.

I model two variants of the same conflict scenario. The first is a conflict between the United States and China over Taiwan. In this scenario, both Taiwan and China are cut off from the United States through a large increase in iceberg costs. The second scenario is more illustrative and examines the case where only Taiwan is cut off. In this scenario, only trade between Taiwan and the United States is subject to a large increase in iceberg costs. This allows for a closer look at a sector like semiconductors, which is particularly interesting because it has been the subject of industrial policy, notably through the CHIPS Act.

6.3 A Quantitative Model

The economy consists of four countries: the United States (Sovereign), denoted by $i = S$, and three trading partners, $j \in \mathcal{J}$: China (Adversary), Taiwan, and the rest of the world. The domestic economy of the United States is modeled as a general equilibrium economy, while the trading partners are modeled using a set of international supply and demand functions.

The model takes Fajgelbaum et al. (2020) (FGKK) as its starting point. On the one hand it simplifies it by abstracting from the regional structure and simplifying the nesting structure. On the other it extends it to allow for two features that the example in Section 4.2.2 may be important for the shape of the derived demand curve for capital. First, it adds a CES nest to capture the idea that intermediate goods are especially hard for firms to substitute. Intuitively, a car manufacturer may find it difficult to substitute semiconductors by adding an extra engine. This nest lowers the elasticity of demand for goods that are primarily sold as intermediate goods. Second, it allows for heterogeneous trade elasticities. Intuitively, both advanced semiconductors and screws may mostly be used as intermediate goods and be critical to production. Yet, it may be easier to substitute source country for screws as compared to semiconductors. Heterogeneous trade elasticities allow the model to capture this possibility.

The United States Economy The domestic representative household consumes final goods $C_g^{S,z}$, with preferences following a Cobb-Douglas form, where β_g^S represents expenditure shares:

$$u^{S,z} = \sum_{g \in \mathcal{G}} \beta_g^S \ln C_g^{S,z}. \tag{58}$$

Final goods are produced by combining domestic goods $D_g^{S,z}$ with imported goods $X_g^{S,z}$. Final goods in sector g can be used for consumption or as an intermediate good by another sector h, denoted by $M_{hg}^{S,z}$.

$$C_g^{S,z} + \sum_{h \in \mathcal{G}} M_{hg}^{S,z} = \left(A_{Dg}^{\frac{1}{\kappa}} \left(D_g^{S,z}\right)^{\frac{\kappa-1}{\kappa}} + A_{Xg}^{\frac{1}{\kappa}} \left(X_g^{S,z}\right)^{\frac{\kappa-1}{\kappa}} \right)^{\frac{\kappa}{\kappa-1}}$$

where the elasticity of substitution between domestic and imported goods is given by κ. Imported goods represent a bundle from all $j \in \mathcal{J}$ trading partners, each producing a country-specific variety. Sovereign imports of a good j are denoted by $x_{jg}^{Sj,z}$. The varieties are combined using a CES aggregator with heterogeneous elasticities of substitution, denoted by η_g:

$$X_g^{S,z} = \left(\sum_{j \in \mathcal{J}} a_{Xjg}^{\frac{1}{\eta_g}} \left(x_{jg}^{S,z} \right)^{\frac{\eta_g - 1}{\eta_g}} \right)^{\frac{\eta_g}{\eta_g - 1}} \tag{59}$$

Sovereign produces its own variety in each sector using sector-specific capital $k_g^{S,z}$ and a sector-specific intermediate input good $M_g^{S,z}$, which is itself a bundle of intermediates from all other sectors. Output is either consumed domestically or exported,

$$D_g^{S,z} + \sum_{j \in \mathcal{J}} \left(1 + \tau_{Sg}^{j,z}\right) x_{Sg}^{j,z} = b_{Sg} \left(k_g^{S,z}\right)^{\alpha_g} \left(M_g^{S,z}\right)^{1-\alpha_g}$$

where, $\tau_{Sg}^{j,z}$ represents iceberg trade costs incurred when j imports from Sovereign. Sector-specific intermediate goods are produced by combining intermediate goods from all other sectors using a CES aggregator with an elasticity of substitution denoted by ϵ, namely,

$$M_g^{S,z} = \left(\sum_{h \in \mathcal{G}} a_{Mgh}^{\frac{1}{\epsilon}} \left(M_{gh}^{S,z} \right)^{\frac{\epsilon-1}{\epsilon}} \right)^{\frac{\epsilon}{\epsilon-1}}.$$

The expression for the strategic value of capital does not rely on a specific functional form assumption for the investment technology. Therefore we do not specify it. We effectively initiate the economy in stage 2 which takes a vector $\bar{\mathrm{k}}_g^S$ of sector-specific capital goods as given.

Trading Partners Sovereign's trading partners are represented by supply curves for different varieties and demand curves for Sovereign's varieties. The domestic price in Sovereign for a variety jg is

$$p_{jg}^{S,z} = (1 + \tau_{jg}^{Sj,z}) b_{jg} \left(x_{jg}^{Sj,z} \right)^{\omega}. \tag{60}$$

Here, $\tau_{jg}^{Sj,z}$ represents the iceberg costs paid by Sovereign for imports from j. These iceberg costs will be shocked to simulate a conflict. Foreign demand for Sovereign's variety is given by:

$$x_{Sg}^{j,z} = a_{Sg}^{j} \left((1 + \tau_{Sg}^{j,z}) p_{Sg}^{S,z} \right)^{-\sigma} \tag{61}$$

where $\tau_{Sg}^{j,z}$ are the iceberg costs paid by j for imports from Sovereign.

Solving the Model The model is solved using exact hat algebra (Dekle et al. (2008)). Rather than solving the model in levels, it is solved in terms of changes in variables, such as capital prices $\hat{r}_g^S = \frac{\bar{r}_g^{S,C}}{\bar{r}_g^{S,P}}$, in response to shocks. This approach is effective for computing the marginal strategic value capacity, as the sufficient statistic (57) only requires knowledge of changes in the value of capital between peace and conflict, not the levels. Computational details can be found in Appendix E.2

Data The model is calibrated using detailed BEA input-output data and census trade data. The BEA industry codes are typically at the NAICS6 level but are sometimes more aggregated at the NAICS4 or NAICS5 level. The input-output data is used to calibrate all expenditure shares, except those related to imports and exports of different trading partners. All cross-sectional analyses use detailed data from 2017, while the time series exercise uses the detailed tables available from 1997 to 2017. Non-tradable sectors are aggregated into a single sector for analysis. The final analysis for 2017 is conducted on 241 sectors. The import and export shares of different trading partners are calibrated based on trade flow data at the HS6 level for the same years the IO table is available. Additional details can be found in Appendix E.3

Calibration The calibration of the parameters is provided in Table 1. The calibration follows FGKK wherever possible. The elasticity of substitution between intermediate goods is taken from Atalay (2017). To compute trade elasticities, I use the values from Broda and Weinstein (2006) for the HTS and SITC-5 industry codes. Both sets of elasticities are matched to their corresponding HS6 codes and then weighted by import shares to compute a trade elasticity for each detailed IO industry code. To compute a single trade elasticity by sector, the two measures are averaged. Additional details and discussion of the calibration is found in Appendix E.4

6.4 Results

Table 1: Externally calibrated parameters

Symbol	Parameter	Value	Source
κ	EoS between foreign and domestic goods	1.19	FGKK (2020)
η_g	EoS between different countries	Heterogeneous	BW (2006)
ϵ	EoS between intermediate goods	0.1	Atalay (2017)
σ	Foreign inverse demand elasticity	1.04	FGKK (2020)
ω	Foreign inverse supply elasticity	0	FGKK (2020)

6.4.1 Results in the 2017 Cross-section

Ranking Strategic Sectors The top five industries for both scenarios are reported in Table 2.

The first, and perhaps most interesting, observation is that the theory ranks semiconductors first out of 241 for the Taiwan scenario. This is the sector that the United States is currently targeting with industrial policy through the CHIPS Act, with the stated objective of reducing dependency on Taiwan. While it is not a test of the theory, it is interesting that the ranking aligns with current policy priorities. In the first scenario the semiconductor sector is ranked 16th out of 241 sectors with a strategic value of 0.097. Appendix E.5.1 takes a closer look at the semiconductor sector. It makes two observations. First, the NAICS sector associated with semiconductors is broader than just chips. Second, the presence of global value chains implies that many chips produced in Taiwan are first sent elsewhere and hence do not appear in the import data. If calibration of the import shares is updated to reflect these two considerations then semiconductors are ranked fifth in the first scenario.[23]

The second observation is that the strategic values for the Taiwan scenario are relatively small. As seen from (57), the theory suggests interpreting the reported numbers as an upper bound on the optimal subsidy. An upper bound of around a subsidy of about 7 percent does not provide a strong case large investment subsidies. Appendix E.5.1 shows that this upper bound increases to about 30 percent when the calibration of the import shares for the semiconductor sector are updated.

The third observation is that the numbers for China are substantially larger than for Taiwan. China is simply a lot bigger than Taiwan which strengthens the argument for investment subsidies

[23] The import share under the updated calibration doubles from about 20 percent to 40 percent for Taiwan and China.

substantially. This scenario can support an upper bound on subsidies of 106 percent.

Table 2: US Strategic Industries

Rank	Sector	Strategic Value
Scenario 1: Taiwan+China		
1	Broadcast and wireless communications equipment	1.066
2	Lighting fixture manufacturing	0.774
3	Telephone apparatus manufacturing	0.636
4	Computer terminals and other computer peripheral equipment manufacturing	0.438
5	Communication and energy wire and cable manufacturing	0.330
Scenario 2: Taiwan		
1	Semiconductor and related device manufacturing	0.076
2	Motor vehicle electrical and electronic equipment manufacturing	0.028
3	Hardware manufacturing	0.024
4	Turned product and screw, nut, and bolt manufacturing	0.024
5	Manufacturing and reproducing magnetic and optical media	0.016

Note: Strategic values are reported for $\theta^A = 1$ and an iceberg cost shock of 10000 for each sector.

Some Determinants of Strategic Value To better understand what drives strategic value in the model, Table 3 reports some of the factors that the example in Section 5 suggested were important. First, the example suggests that import shares matter: the larger the initial shock to demand, the greater the price movement. This seems to be reflected in the table. Second, the example indicates that the elasticity of demand is important. Since intermediate goods are hard to substitute, this is partially captured by the share of goods sold as intermediate goods. This relationship seems to hold well for Taiwan but not as much for China. The interpretation is not necessarily that the relationship is spurious, but rather that import shares may be more important. Lastly, the example suggests that trade elasticities matter. This is captured by the model, as the most strategically valuable sectors tend to have lower trade elasticities.

Should National Security Policy Target a Narrow Range of Sectors? Some economists have expressed the view that national security considerations can justify market interventions but should be limited to a narrow set of sectors. The Strategic Value column in Table 3 can be interpreted as both supporting and challenging this view.

On the one hand, the strategic value declines rapidly as one moves down the ranking, dropping by about two-thirds when moving from the top 5 to the top 25 sectors. On the other hand, NAICS6 industry codes still represent very large sectors. Thus, while the quantitative exercise supports the idea of targeting a narrow range of sectors, the subsidies may still affect a substantial portion of the economy.

Table 3: Comparison of Strategic Industries for China+Taiwan and Taiwan Scenarios

Top	Strategic Value	Import Share	Intermediate Sales Share	Trade Elasticity
Scenario 1: China+Taiwan				
5	0.649	0.589	0.421	1.643
25	0.221	0.494	0.414	1.899
50	0.107	0.437	0.489	2.161
100	0.024	0.343	0.476	2.602
Scenario 2: Taiwan				
5	0.033	0.119	0.746	2.004
25	0.012	0.055	0.554	2.020
50	0.005	0.044	0.500	2.187
100	0.001	0.031	0.474	3.590

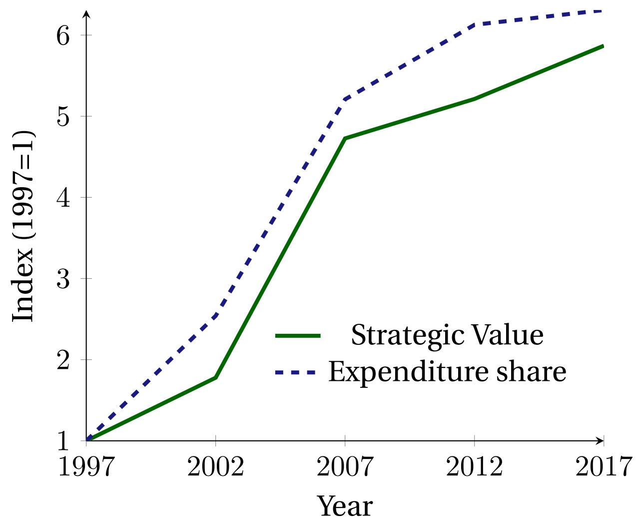
Note: Strategic values are reported for $\theta^A = 1$ and an iceberg cost shock of 10000 for each sector. All reported numbers are simple averages. Import shares refer to shares of total imports and add up to 1. Intermediate sale shares refer to the share of goods sold domestically as intermediate goods as compared to final goods.

6.4.2 Results Over Time

The Rise of China and the Value of Reshoring the American Industrial Base One of the most significant changes in great power competition in the 20th century was the introduction of thermonuclear weapons. In the 21st century, the biggest change may well be the expansion of global trade. While trade with the Soviet Union was modest, China is deeply integrated into the global economy. Trade with the United States, in particular, expanded significantly after China joined the WTO in late 2001.

To assess how the increase in trade affects the argument for reshoring American industrial capacity, I repeat the analysis for the years between 1997 and 2017, using the BEA detailed IO tables, which are published every five years. Industries are ranked for each year, and the average strategic value of the top 10 percent is computed and reported in Figure 5. The index keeps θ^A fixed; if one believes that rising geopolitical tensions have increased θ^A, the index should be interpreted as a lower bound. Appendix E.5.2 shows the pattern is robust to choosing different percentiles.

Figure 5: Globalization and the growing value of strategic investment policy



Note: Strategic values are reported for an iceberg cost shock of 10000 for each sector. Since it is an index it is invariant to the choice of θ^A. The expenditure share refers to the expenditure of imports from Taiwan and China as a fraction of all expenditure in that sector. The figure reports a simple average for the top 10 percent of sectors

Figure 5 suggests that the value of reshoring strategic capacity increases roughly in line with the rise in expenditure on imports from China. This implies that the strategic use of investment policy is complementary to the increase in the volume of trade. As global trade expands, the value of investment policy aimed at reshoring or retaining productive capacity also rises. Given the substantial growth in trade, the value of targeted investment policy has increased more than fivefold between 1997 and 2017.

7. Conclusion

This paper presented a theory of the national security externality. This externality leads markets to undervalue the strategic value of domestic resilience and overvalue that of an adversary. It then presented results on the strategic rationales for trade and industrial policies that alleviate the national security externality by directly intervening in the decisions that generate resilience to conflict. The paper showed that investment subsidies to the defense industrial base, reshoring, friendshoring, investment in the capacity to adjust, and various ways of weaponizing trade can be studied from this perspective.

Perhaps the main conclusion is that national security concerns are simple to incorporate into the standard economic framework once one builds on the now-standard interpretation of conflict as a bargaining problem. By incorporating this into a standard general equilibrium framework, one obtains a framework that can be applied to a wide range of national security questions.

The framework developed here could be extended to study a wider range of policy questions than those explored in this paper. The first margin would be to extend the general equilibrium block. The missing market for power suggests that the government would need to intervene in any decision affecting resilience. The other margin would be to extend the bargaining model to incorporate different strategic motivations. This paper emphasized only one feature of the bargaining model—the role of resilience in producing bargaining power—but there are others, such as those highlighted in the literature studying the war puzzle, such as the inability to commit to future actions. These additional features could provide further rationale for market intervention. Both of these avenues could be valuable directions for future research.

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A. Extensions to the bargaining environment in Section 2

A.1 The Case of Asymmetric Information

To model bargaining with asymmetric information, I study an ultimatum game. With probability θ^A, Sovereign receives an offer from Adversary. Before receiving an offer, but after investing, it draws an additive preference shock that shifts its cost of conflict. It is denoted by $\zeta^{S,C}$ and is distributed according to a cumulative distribution function $F(\zeta)$. If player i accepts the offer, it is implemented, and there is peace; otherwise, there is conflict, and B is allocated exogenously, as was the case before.

Capital is again suppressed as an argument to ease notation. Sovereign rejects an offer by Adversary when:

$$\zeta^{S,C} < B_A^{S,P} - B^{S,C} - R^S$$

where $B_A^{S,P}$ denotes the bargaining goods A proposes that S would receive if they accept the offer, and R^S is defined according to (7). The probability of conflict is then given by:

$$\mathcal{P}^{A,C}(B_A^{S,P}, R^S) \equiv F(B_A^{S,P} - B^{S,C} - R^S).$$

Suppose Adversary gets to propose. It then chooses a $B_A^{S,P}$ to maximize its expected welfare:

$$B_A^{S,P} \in \text{argmax}\, \mathcal{P}^{A,P}(B_A^{S,P}, R^S)\left(V^{A,P} + \bar{B} - B_A^{S,P}\right) + \left(1 - \mathcal{P}^{A,P}(B_A^{S,P}, R^S)\right)\left(V^{A,C} + B^{A,C}\right).$$

We denote the solution of this problem as a function of R^S as $B_A^{S,P}(R^S)$ and assume it is differentiable in R^S.

Next, I state Sovereign's problem over $\bar{\mathbf{k}}^S$ and $B_S^{A,P}$:

$$\max_{\bar{\mathbf{k}}^S} (1-\theta^A)\left(V^{S,P} + B_{sq}^{S,P}\right) + \theta^A\left[\int_{\underline{\zeta}}^{\bar{\zeta}} \max\left[V^{S,P} + B_A^{S,P}\left(R^S\right), V^{S,C} + B^{S,C} + \zeta^{S,C}\right] f(\zeta^{S,C}) d\zeta^{S,C}\right]$$

subject to (10). Here $B_{sq}^{S,P}$ denotes a status quo allocation of the bargaining good if conflict is skipped.

The first-order condition with respect to capital for this problem is given by:

$$\mathcal{P}^P \frac{\partial V^{S,P}}{\partial \bar{k}_g^S} + \mathcal{P}^C \frac{\partial V^{S,C}}{\partial \bar{k}_g^S} + \theta^A \mathcal{P}_A^P \frac{\partial B_A^{S,P}}{\partial R^S}\left(\frac{\partial V^{S,C}}{\partial \bar{k}_g^S} - \frac{\partial V^{S,P}}{\partial \bar{k}_g^S}\right) = \hat{\mu}^S \tag{A.1}$$

here $\mathcal{P}^P = 1 - \theta^A + \theta^A \mathcal{P}^{A,P}$ was used to simplify the expression.

Competitive equilibrium The firm's problem is to maximize:

$$(\bar{k}_0^i, \bar{k}_1^i) \in \operatorname{argmax} \left\{ \sum_{z \in \{P,C\}} \mathcal{P}^z \sum_{g \in \{0,1\}} r^{i,z} \bar{k}_g^i (1 + s_g^{i,z}) | \sum_{g \in \{0,1\}} \bar{k}_g^i = \bar{k}^i \right\} \tag{A.2}$$

The first-order condition for the firm is therefore given by:

$$\mathcal{P}^P r_g^{i,P} (1 + s_g^{i,P}) + \mathcal{P}^C r_g^{i,C} = \mu^i \tag{A.3}$$

Solving for the optimal subsidy The relationship between stage 3 welfare and prices for capital goods is still given by:

$$\frac{\partial V^{S,z}}{\partial \bar{k}_g^S} = \frac{\partial u^{S,z}}{\partial c_g^{S,z}} = r_g^{S,z}. \tag{A.4}$$

Combining the first-order conditions for consumption for the household and investment for the production firm yields:

$$\frac{\partial u^S}{\partial c_g^{S,z}} \frac{\partial f_g^S}{\partial k_g^{S,z}} = \lambda^{S,z} r_g^{S,z} \tag{A.5}$$

The first-order condition for the government can now be written as:

$$\mathcal{P}^P r_g^{S,P} + \mathcal{P}^C r_g^{S,C} + \theta^A \mathcal{P}_A^P \frac{\partial B_A^{S,P}}{\partial R^S} \left(r_g^{S,P} - r_g^{S,C} \right) = \hat{\mu}^S. \tag{A.6}$$

Rescaling subsidies such that $\mu^S = \hat{\mu}^S$ one obtains:

$$(1 + s_g^{S,P}) = \theta^A \mathcal{P}_A^P \frac{\partial B_A^{S,P}}{\partial R^S} \frac{r_g^{S,P} - r_g^{S,C}}{r_g^{S,P}} = \theta^A \mathcal{P}_A^P \frac{\partial B_A^{S,P}}{\partial R^S} \left(\frac{r_g^{S,C}}{r_g^{S,P}} - 1 \right). \tag{A.7}$$

A.2 Arms, Influence and Resilience

The stage 3 welfare condition is generalized to

$$V^{i,z}(\bar{k}_0^i, \bar{k}_1^i, d_1^{i,z}) \equiv \max_{\{c_0^{i,z}, c_1^{i,z}\}} u^i(c_0^{i,z}, c_1^{i,z}) \quad \text{subject to (1)-(3)}.$$

The resulting stage 1 planning problem is then given by

$$\begin{aligned} \max_{\bar{k}_0^S, \bar{k}_1^S, d_1^{S,z}} \quad & V^{S,P}(\bar{k}_0^S, \bar{k}_1^S, d_1^{S,P}) + \theta^A \left(V^{S,C}(\bar{k}_0^S, \bar{k}_1^S, d_1^{S,C}) - V^{S,P}(\bar{k}_0^S, \bar{k}_1^S, d_1^{S,P}) \right) \\ & + h(d_1^{S,C}) + \mathcal{Z}_1 \end{aligned}$$

subject to (10) and $d_1^{S,z} \geq 0$

where

$$\mathcal{Z}_1 \equiv B^{S,C} - h(d_1^{A,C}) + \theta^S \left(V^{A,C} - V^{A,P}\right).$$

The first order condition for the planner is identical to that in the main text. It follows immediately that the investment subsidy is unchanged.

B. Additional details for the setup

B.1 Decisions problems and definitions in Section 2

The decisions problems and of profits and lump sum taxes are given by:

$$\left(\mathbf{c}^{i,z}\right) \in \operatorname{argmax}\left\{B^{i,z} + u^i(\mathbf{c}^{i,z}) | \sum_{g\in\mathcal{G}} p_g^{i,z} c_g^{i,z} = \Pi^{i,z} + T^{i,z} + \sum_{\ell\in\mathcal{L}} w_\ell^{i,z} \bar{l}_\ell^i\right\} \tag{B.1}$$

$$\left(\mathbf{k}_g^{i,z}, \mathbf{l}_g^{i,z}, \mathbf{m}_g^{i,z}\right) \in \operatorname{argmax}\left\{p_g^{i,z} F_g^{i,z}(\mathbf{k}_g^{i,z}, \mathbf{l}_g^{i,z}, \mathbf{m}_g^{i,z}) - \sum_{f\in\mathcal{F}} r_f^{i,z} k_{gf}^{i,z} - \sum_{\ell\in\mathcal{L}} w_\ell^{i,z} l_{g\ell}^{i,z} - \sum_{h\in\mathcal{G}} p_g^{i,z} m_{gh}^{i,z}\right\} \tag{B.2}$$

$$\left(\bar{\mathbf{k}}^i\right) \in \operatorname{argmax}\left\{\sum_{f\in\mathcal{F}} r_f^{i,P}(1+s_f^i)\bar{k}_f^i | G(\bar{\mathbf{k}}_f^i) \leq \bar{k}^i\right\} \tag{B.3}$$

$$\Pi^{i,z} = \sum_{g\in\mathcal{G}}\left(p_g^{i,z} y_g^{i,z} - \sum_{f\in\mathcal{F}} r_f^{i,z} k_{gf}^{i,z} - \sum_{\ell\in\mathcal{L}} w_\ell^{i,z} l_{g\ell}^{i,z}\right) + \sum_{f\in\mathcal{F}} r_f^{i,P}(1+s_f^i)\bar{k}_f^i \tag{B.4}$$

$$T^{i,z} = \sum_{f\in\mathcal{F}} r_f^{i,P} s_f^i \bar{k}_f^i + \sum_{g\in\mathcal{G}} p_g^{i,z} d_g^{i,z} - \sum_{g\in\mathcal{G}}\sum_{j\in\mathcal{J}} p_g^{i,z} x_g^{i,z} t_g^{i,z}.. \tag{B.5}$$

B.2 Extended bargaining game

The section show how the bargaining game can be extended such that $\theta^A + \theta^S < 1$ but things are otherwise essentially unchanged. Suppose that bargaining good is divided according to the Generalized Nash Bargaining solution with probability π. Let us denote the allocation of the bargaining good after bargaining $\tilde{B}^{i,P}$. The GNB solution is now given by

$$(\tilde{B}^{S,P}, \tilde{B}^{A,P}) \in \operatorname{argmax}\left(\tilde{B}^{S,P} - R^S - B^{S,C}\right)^{\delta^S}\left(\tilde{B}^{A,P} - R^A - B^{A,C}\right)^{\delta^A}$$
$$\text{subject to} \quad (5)$$

where $\delta^S + \delta^A = 1$. Whenever there is no bargaining we assume there is peace and the bargaining good is allocated exogenously. Let us denoted the allocation by $\dot{B}^{i,P}$. Let us also assume that is equals $B^{i,C}$. One could think of $B^{i,C}$ as some status quo allocation. Denote the expected bargaining good during peace by $B^{i,P}$. Sovereign's bargaining goods are now given by:

$$B^{S,P} = \pi\tilde{B}^{S,P} + (1-\pi)\dot{B}^{S,P} = \pi\delta^A R^S + \pi\delta^S R^A + \pi B^{S,C} + (1-\pi)B^{S,C} \tag{B.6}$$

$$= \theta^A R^S + \theta^S R^A + B^{S,C} \tag{B.7}$$

here $\theta^i \equiv \pi\delta^i$. Since π can be lower than 1 it follows that $\theta^A + \theta^S$ can be lower than one.

C. Proof of propositions

This appendix provides the proofs for the propositions and the formulation of the primal planning problem.

C.1 Formulation of the primal planning problem

To formulate the planning problem, we take a three-step approach. First, we provide some necessary and sufficient conditions for a pattern of trade to be consistent with international prices and capital investment for each trading partner. This allows us to track their welfare using (41). Second, we allow Sovereign to choose domestic allocations directly and only track welfare as a function of trade and investment using (41). Third, we impose any competitive equilibrium conditions not covered in the first two steps directly as part of the planning problem.

We begin with the first step. Any pattern of trade for the trading partners that is part of a competitive equilibrium needs to be consistent with a country's domestic competitive equilibrium conditions given international prices. We define a domestic competitive equilibrium as follows:

Definition 5 (Domestic competitive equilibrium)**.** *Given policies $\{\mathbf{t}^{i,z}, \mathbf{s}^i\}$, international prices $\mathbf{q}^{i,z}$ and outcomes of the bargaining game z and $B^{i,z}$, a domestic competitive equilibrium consists of prices $\{\mathbf{p}^{i,z}, \mathbf{r}^{i,z}, \mathbf{w}^{i,z}\}$, an allocation of factors $\{\mathbf{k}^{i,z}, \bar{\mathbf{k}}^i, \mathbf{l}^{i,z}\}$, consumption, production, and intermediate goods $\{\mathbf{c}^{i,z}, \mathbf{y}^{i,z}, \mathbf{m}^{i,z}\}$, a pattern of trade $\mathbf{x}^{i,z}$, and a lump sum transfer $T^{i,z}$ that satisfy agent optimization, domestic market clearing, the government budget constraints and the trade balance conditions.*

Since all trading partners are assumed to be competitive economies without policy, one might expect, based on the welfare theorems, that there is a relationship between welfare conditional on capital and trade, as in (41), and the realized pattern of investment and trade. Lemma 1 shows that this intuition holds:

Lemma 1. *$q_g^{j,z}, x_g^{j,z}$ and $\bar{k}_f^j$ are part of a domestic competitive equilibrium in j, if and only if,*

$$(\bar{\mathbf{k}}^j) \in \text{argmax}\left\{V^{j,P}(\bar{\mathbf{k}}^j, \mathbf{x}^{j,P}) \mid G(\bar{\mathbf{k}}_f^j) \leq \bar{k}^j\right\},$$
$$(\mathbf{x}^{j,z}) \in \text{argmax}\left\{V^{j,P}(\bar{\mathbf{k}}^j, \mathbf{x}^{j,z}) \mid \sum_{g\in\mathcal{G}} q_g^{j,z} x_g^{j,z} = 0\right\}.$$

Sovereign chooses trade patterns, taking into account that the resulting capital allocations and international prices must be consistent with the domestic competitive equilibria of each trading partner. To that end, we denote capital in j as a function of exports from Sovereign as $\bar{\mathbf{k}}^j(\mathbf{x}^{Sj,P})$, and the associated prices as $q_g^{j,z}(\mathbf{x}^{Sj,z}, \bar{\mathbf{k}}^j(\mathbf{x}^{Sj,P}))$. Here, we have replaced $\mathbf{x}^{j,z}$ using the trade market clearing condition (37). These functions are assumed to be differentiable.

The planning problem So far, we have dealt with most conditions of the competitive equilibrium. The conditions relevant to Stage 3 were absorbed into (41). Foreign competitive equilibria were dealt with by summarizing them as convenient functions of Sovereign's trade pattern. We are left with two restrictions for Sovereign: the investment constraint (33) and the trade balance condition (39). These are imposed as constraints. The international market clearing condition (37) must also hold and is directly substituted into the objective function. This results in the following planning problem

$$\begin{aligned}
\max_{\bar{\mathbf{k}}^S, \mathbf{x}^{S,z}} \quad & V^{S,P}(\bar{\mathbf{k}}^S, \mathbf{x}^{S,P}) + \underbrace{\theta^A \left(V^{S,C}(\bar{\mathbf{k}}^S, \mathbf{x}^{S,C}) - V^{S,P}(\bar{\mathbf{k}}^S, \mathbf{x}^{S,P})\right)}_{\text{Defensive motive}} \\
& - \underbrace{\theta^S \left(V^{A,C}(-\mathbf{x}^{S,C}, \bar{\mathbf{k}}^A(\mathbf{x}^{S,P})) - V^{A,P}(-\mathbf{x}^{S,P}, \bar{\mathbf{k}}^A(\mathbf{x}^{S,P}))\right)}_{\text{Offensive motive}} + B^{S,C} \\
\text{subject to} \quad & G(\bar{\mathbf{k}}^S) \leq \bar{k}^S \\
& \sum_{g\in\mathcal{G}} q^{j,z}(\mathbf{x}^{Sj,z}, \bar{\mathbf{k}}^j(\mathbf{x}^{Sj,P}))x_g^{Sj,z} = 0 \quad \forall j \in \mathcal{J}.
\end{aligned}$$

C.2 Proof for lemma 1

To prove the statement we will first show that we can start with the conditions characterizing a domestic competitive equilibrium and derive the conditions in the lemma. Then we go the other way, starting with the conditions of the lemma we show we can construct prices and incomes such that the competitive equilibrium conditions hold. We begin by stating the full set of conditions for both cases. Throughout we assume that first order conditions are necessary and sufficient to characterize the solution to the relevant optimization problems.

Competitive equilibrium conditions The first order condition for households is given by

$$\frac{\partial u^{i,z}(\mathbf{c}^{i,z})}{\partial c_g^{i,z}} = \lambda^{i,z} p_g^{i,z} \tag{C.1}$$

The first order conditions for the production firms are given by

$$p_g^{i,z} \frac{\partial F_g^{i,z}(\mathbf{k}_g^{i,z}, \mathbf{l}_g^{i,z}, \mathbf{m}_g^{i,z})}{\partial m_{gh}^{i,z}} = p_h^{i,z} \tag{C.2}$$

$$p_g^{i,z} \frac{\partial F_g^{i,z}(\mathbf{k}_g^{i,z}, \mathbf{l}_g^{i,z}, \mathbf{m}_g^{i,z})}{\partial k_{gf}^{i,z}} = r_f^{i,z} \tag{C.3}$$

$$p_g^{i,z} = \frac{\partial F_g^{i,z}(\mathbf{k}_g^{i,z}, \mathbf{l}_g^{i,z}, \mathbf{m}_g^{i,z})}{\partial l_{g\ell}^{i,z}} = w_\ell^{i,z} \tag{C.4}$$

The first order condition for the investment firm is given by:

$$r_f^{i,P} = \mu^i \frac{\partial G^i}{\partial \bar{k}_f^i} \tag{C.5}$$

The remaining conditions are given by factor market clearing conditions and technology constraints(35)-(33), the income definitions (B.4)-(B.5) the goods market clearing condition(**??**), the trade balance condition and the definition of domestic prices (39)-(38) and the consumer budget constraint:

$$\sum_{g \in \mathcal{G}} p_g^{i,z} c_g^{i,z} = \Pi^{i,z} + T^{i,z} + \sum_{\ell \in \mathcal{L}} w_\ell^{i,z} \bar{l}_\ell^i \tag{C.6}$$

Planning problem conditions We combine the first order conditions for the two conditions in the Lemma with the envelope conditions to obtain:

$$\frac{\partial V^{i,P}(\bar{\mathbf{k}}^i, \mathbf{x}^{i,P})}{\partial \bar{k}_f^i} = \hat{\mu}^i \frac{\partial G^i}{\partial \bar{k}_f^i} = \hat{\lambda}^{i,z} \hat{\phi}_f^{i,P} \tag{C.7}$$

$$\frac{\partial V^{i,z}(\bar{\mathbf{k}}^i, \mathbf{x}^{i,z})}{\partial x_g^{i,z}} = \hat{\lambda}^{i,z} q_g^{i,z} = \hat{\lambda}^{i,z} \hat{\delta}_g^{i,z} \tag{C.8}$$

here $\hat{\mu}^i$ and $\hat{\lambda}^{i,z}$ are the multiplier on the investment technology and trade balance condition respectively. The allocation of goods not mentioned in the lemma is characterized by the first order conditions of the envelope condition.

$$\frac{\partial u^{i,z}(\mathbf{c}^{i,z})}{\partial c_g^{i,z}} = \hat{\lambda}^{i,z}\hat{\delta_g}^{i,z} \tag{C.9}$$

$$\hat{\lambda}^{i,z}\hat{\delta}_g^{i,z}\frac{\partial F_g^{i,z}(\mathbf{k}_g^{i,z},\mathbf{l}_g^{i,z},\mathbf{m}_g^{i,z})}{\partial m_{gh}^{i,z}} = \hat{\lambda}^{i,z}\hat{\delta}_h^{i,z} \tag{C.10}$$

$$\hat{\lambda}^{i,z}\hat{\delta_g}^{i,z}\frac{\partial F_g^{i,z}(\mathbf{k}_g^{i,z},\mathbf{l}_g^{i,z},\mathbf{m}_g^{i,z})}{\partial k_{gf}^{i,z}} = \hat{\lambda}^{i,z}\hat{\phi}_f^{i,z} \tag{C.11}$$

$$\hat{\lambda}^{i,z}\hat{\delta}_g^{i,z} = \frac{\partial F_g^{i,z}(\mathbf{k}_g^{i,z},\mathbf{l}_g^{i,z},\mathbf{m}_g^{i,z})}{\partial l_{g\ell}^{i,z}} = \hat{\lambda}^{i,z}\hat{\varphi}_\ell^{i,z} \tag{C.12}$$

here $\hat{\lambda}^{i,z}\hat{\delta_g}^{i,z}$ is the multiplier on the goods market clearing condition, $\hat{\lambda}^{i,z}\hat{\phi}_f^{i,z}$ is the multiplier on the capital market clearing condition and $\hat{\lambda}^{i,z}\hat{\varphi}_\ell^{i,z}$ is the multiplier on the labor market clearing condition. These multipliers have been rescaled with $\hat{\lambda}^{i,z}$ to simplify the mapping to the marginal utility of income and prices. The remaining conditions are given by factor market clearing conditions and technology constraint (35)-(33), the goods market clearing condition (**??**), the trade balance condition (39)

Starting with competitive equilibrium conditions Suppose that $(\bar{\mathbf{k}}^i, \mathbf{x}^{i,z}, \mathbf{q}^{i,z})$ satisfy the domestic competitive equilibrium conditions. We combine (C.1) with (38) to obtain:

$$\frac{\partial u^{i,z}(\mathbf{c}^{i,z})}{\partial c_g^{i,z}} = \lambda^{i,z}p_g^{i,z} = \lambda^{i,z}q_g^{i,z}$$

Similarly combining (C.8),(C.9) yields:

$$\frac{\partial u^{i,z}(\mathbf{c}^{i,z})}{\partial c_g^{i,z}} = \hat{\lambda}^{i,z}q_g^{i,z} = \hat{\lambda}^{i,z}\hat{\delta_g}^{i,z}$$

We can construct $\hat{\lambda}^{i,z}$ as $\hat{\lambda}^{i,z} = \lambda^{i,z}$ and $\hat{\delta}_g^{i,z}$ as $q_g^{i,z} = p_g^{i,z}$. We can construct prices for capital goods and labor from the related first order conditions as $\hat{\phi}_f^{i,z} = r_f^{i,z}$ and $\hat{\varphi}_\ell^{i,z} = w_\ell^{i,z}$ using (C.3) and (C.4). Lastly we use (C.5) and (C.7) to construct $\hat{\mu}^i = \mu^i$. The remaining conditions are technology constraint and market clearing conditions which we have imposed on both problems.

Starting with planning conditions Suppose that $(\bar{\mathbf{k}}^i, \mathbf{x}^{i,z}, \mathbf{q}^{i,z})$ satisfy the domestic competitive equilibrium conditions. We start by combining (C.8) and (C.9) to construct $\lambda^{i,z}$ as $\lambda^{i,z} = \hat{\lambda}^{i,z}$ and also prices as $p_g^{i,z} = \hat{\delta_g}^{i,z}$. We can use the multipliers on (C.11) and (C.12) to construct prices as $r_f^{i,z} = \hat{\phi}_f^{i,z}$ and $w_\ell^{i,z} = \hat{\varphi}_\ell^{i,z}$. We can construct $\mu^i = \hat{\mu}^i$ from (C.7). We can construct the income definitions (B.4)-(B.5). by defining $T^{i,z}$ and $\Pi^{i,z}$ such that they hold. Now we check that given these definitions the consumer budget constraint is also satisfied. Take the goods market clearing condition (**??**), multiply it by $p_g^{i,z}$ and sum them to obtain:

$$\sum_{g\in\mathcal{G}} p_g^{i,z} c_g^{i,z} + \sum_{g\in\mathcal{G}} p_g^{i,z} d_g^{i,z} + \sum_{g\in\mathcal{G}} p_g^{i,z} \sum_{h\in\mathcal{G}} m_{hg}^{i,z} = \sum_{g\in\mathcal{G}} p_g^{i,z} y_g^{i,z} + \sum_{g\in\mathcal{G}} p_g^{i,z} x_g^{i,z}$$

Use that $p_g^{i,z} = q_g^{i,z}$ to observe that $\sum_{g\in\mathcal{G}} p_g^{i,z} x_g^{i,z} = 0$. Now use the definitions of $T^{i,z}$ and $\Pi^{i,z}$ to obtain that:

$$\sum_{g\in\mathcal{G}} p_g^{i,z} c_g^{i,z} = T^{i,z} + \Pi^{i,z} + \sum_{\ell\in\mathcal{L}} w_\ell^{i,z} \bar{l}_\ell^i$$

hence we have constructed (C.6). The remaining conditions are technology constraint and market clearing conditions which we have imposed on both problems.

C.3 Proof for proposition 2

This proposition is a special case of proposition 4 for the case where $\theta^S = 0$ and $\theta^A = 0$. The result that trade policy during conflict is not necessary follows from the observation that conflict does not appear anywhere in the problem in the absence of bargaining. The result that investment policy is not necessary follows from substituting $\theta^A = 0$ into the expression for proposition 4. The expression for trade policy during peace follows from (C.25) by observing that $\gamma^{SA,P} = 0$, $\gamma^{SA,C} = 0$ and ψ^{Sj} when $\theta^S = 0$ and $\theta^A = 0$. After making these substitutions the problem is identical for any $j \in \mathcal{J}$

C.4 Proof for proposition 3

Optimal investment subsidies The first-order conditions of Sovereign and the investment firm are now given by:

$$\frac{\partial V^{S,P}(\bar{\mathbf{k}}^S)}{\partial \bar{k}_f^S} + \theta^A \left(\frac{\partial V^{S,P}(\bar{\mathbf{k}}^S)}{\partial \bar{k}_f^S} - \frac{\partial V^{S,P}(\bar{\mathbf{k}}^S)}{\partial \bar{k}_f^S} \right) = \hat{\mu}^S \frac{G(\bar{\mathbf{k}}_f^S)}{\partial \bar{k}_f^S} \tag{C.13}$$

$$r_f^{S,P}(1 + s_f^S) = \mu^S \frac{G(\bar{\mathbf{k}}_f^S)}{\partial \bar{k}_f^S} \tag{C.14}$$

There are two differences between (14) and (20) and (C.13)-(C.14). The first point is that the investment technology appears on the R.H.S.; however, it appears in both equations and can be substituted out. The second point is that the subscript is now f rather than g, which turns out to be the more substantive of the two. The envelope condition is now given by $\frac{\partial V^{S,z}}{\partial \bar{k}_f^S} = \lambda^{S,z} r_f^{S,z} \equiv \bar{r}_f^{S,z}$, where $\lambda^{S,z}$ is the multiplier on the consumer budget constraint. There are many subsidies that can implement the same allocation. When subsidies are scaled such that $\mu^S = \frac{\hat{\mu}^S}{\lambda^{S,P}}$, the marginal value of a unit of capital is the same for the firm and the planner. In this case, the proposition follows.

Optimal trade policy This part of the proposition is a special case of proposition 4 for the case where $\theta^S = 0$. The result on investment policy follows from substituting $\theta^S = 0$ into proposition 4. The expression for trade during conflict follows from inspecting (C.20) and noting that $\gamma^{SA,C} = 0$ during conflict. Since nothing depends on Adversary specificaly optimal trade is the same for any $j \in \mathcal{J}$. The expression for trade policy during peace follows from (C.25) by observing that $\gamma^{SA,P} = 0$ and noting that in the case where $\theta^S = 0$ optimal policy vis-a-vis Adversary is the same as that with any $j \in \mathcal{J}$, replacing A with j yields the result.

C.5 Proof for proposition 4

Trade taxes during conflict The first order condition is given by:

$$\theta^A \frac{\partial V^{S,C}(\bar{\mathbf{k}}^S, \mathbf{x}^{S,C})}{\partial x_g^{S,C}} + \theta^S \frac{\partial V^{A,C}(-\mathbf{x}^{S,P}, \bar{\mathbf{k}}^A(\mathbf{x}^{S,P}))}{\partial x_g^{S,P}} - \lambda^{A,C} \hat{\mu}^{SA,C} \left[q_g^{A,C} + \sum_{h \in \mathcal{G}} \frac{\partial q_h^{A,C}}{\partial x_g^{SA,C}} x_h^{SA,C} \right] = 0 \quad \text{(C.15)}$$

We express things in terms of prices by using two envelope conditions:

$$\frac{\partial V^{S,C}(\bar{\mathbf{k}}^S, \mathbf{x}^{S,C})}{\partial x_g^{S,C}} = \lambda^{S,C} p_g^{S,C} = \lambda^{S,C} q_g^{A,C}(1 + t_g^{SA,C}) \quad \text{(C.16)}$$

$$\frac{\partial V^{A,C}(-\mathbf{x}^{S,C}, \bar{\mathbf{k}}^A(\mathbf{x}^{S,P}))}{\partial x_g^{S,C}} = \lambda^{A,C} q_g^{A,C} \quad \text{(C.17)}$$

We obtain that

$$\theta^A \lambda^{S,C} q_g^{A,C}(1 + t_g^{SA,C}) + \theta^S \lambda^{A,C} q_g^{A,C} = \lambda^{A,C} \hat{\mu}^{SA,C} \left[q_g^{A,C} + \sum_{h \in \mathcal{G}} \frac{\partial q_h^{A,C}}{\partial x_g^{SA,C}} x_h^{SA,C} \right] \quad \text{(C.18)}$$

Dividing and rearranging yields :

$$(1 + t_g^{SA,C}) = -\frac{\theta^S}{\theta^A} \frac{\lambda^{A,C}}{\lambda^{S,C}} + \frac{\lambda^{A,C}}{\lambda^{S,C}} \frac{\hat{\mu}^{SA,C}}{\theta^A} \left[1 + \sum_{h \in \mathcal{G}} \frac{\partial q_h^{A,C}}{\partial x_g^{SA,C}} \frac{x_h^{SA,C}}{q_g^{A,C}} \right] \quad \text{(C.19)}$$

We can add and subtract $\frac{\theta^S}{\theta^A}\frac{\lambda^{A,C}}{\lambda^{S,C}}\sum_{h\in\mathcal{G}}\frac{\partial q_h^{A,C}}{\partial x_g^{SA,C}}\frac{x_h^{SA,C}}{q_g^{A,C}}$ and multiply and divide by $\frac{-\theta^S+\hat{\lambda}^{S,C}}{\theta^S}$ and rearrange to obtain that:

$$(1+t_g^{SA,C}) = \frac{\lambda^{A,C}}{\lambda^{S,C}}\frac{-\theta^S+\hat{\mu}^{SA,C}}{\theta^A}\left[1+\left(1+\frac{\theta^S}{-\theta^S+\hat{\mu}^{SA,C}}\right)\sum_{h\in\mathcal{G}}\frac{\partial q_h^{A,C}}{\partial x_g^{SA,C}}\frac{x_h^{SA,C}}{q_g^{A,C}}\right] \tag{C.20}$$

Quasi-linear case When good 0 is a natural numeraire good the first order condition for good 0 becomes

$$\theta^S+\theta^A = \lambda^{A,C}\hat{\mu}^{A,C} = \hat{\mu}^{A,C} \tag{C.21}$$

use that $\lambda^{i,Z}=1$ when good 0 untaxed to obtain

$$1+t_g^{SA,C} = 1+(1+\frac{\theta^S}{\theta^A})\mathcal{E}_g^{SA,CC} \implies t_g^{SA,C} = \frac{1}{\theta^A}\left(\theta^A+\theta^S\right)\mathcal{E}_g^{SA,CC} \tag{C.22}$$

General case We now define $\gamma^{SA,C} \equiv \frac{\theta^S}{-\theta^A+\hat{\mu}^{SA,C}}$ and $\frac{\lambda^{A,C}}{\lambda^{S,C}}\frac{-\theta^S+\hat{\mu}^{SA,C}}{\theta^A} \equiv (1+\bar{t}^{SA,C})$ and use that $\mathcal{E}_g^{Sj,z_1z_2} = \sum_{h\in\mathcal{G}}\frac{\partial q_h^{j,z_1}}{\partial x_g^{Sj,z_2}}\frac{x_h^{Sj,z_1}}{q_g^{j,z_2}}$ to obtain:

$$1+t_g^{SA,C} = \left(1+\bar{t}^{SA,C}\right)\left[1+\left(1+\gamma^{S,C}\right)\mathcal{E}_g^{SA,CC}\right]$$

By Lerner symmetry we can set $\bar{t}^{SA,C}=0$, rearranging then yields the proposition.

Trade taxes during peace The first order condition is given by

$$\begin{aligned}
&(1-\theta^A)\frac{\partial V^{S,P}(\bar{\mathbf{k}}^S,\mathbf{x}^{S,P})}{\partial x_g^{S,P}} - \theta^S\frac{\partial V^{A,P}(-\mathbf{x}^{S,P},\bar{\mathbf{k}}^A(\mathbf{x}^{S,P}))}{\partial x_g^{S,P}} \\
&+\theta^S\sum_{f\in\mathcal{F}}\left[\frac{\partial V^{A,P}(-\mathbf{x}^{S,P},\bar{\mathbf{k}}^A(\mathbf{x}^{S,P}))}{\partial \bar{k}_f^A} - \frac{\partial V^{A,C}(-\mathbf{x}^{S,P},\bar{\mathbf{k}}^A(\mathbf{x}^{S,P}))}{\partial \bar{k}_f^A}\right]\frac{\partial \bar{k}_f^A}{\partial x_g^{SA,P}} \\
&-\sum_{z\in\{P,C\}}\lambda^{A,z}\hat{\mu}^{SA,z}\left[q_g^{A,z}1_{\{z=P\}}+\sum_{h\in\mathcal{G}}\frac{\partial q_h^{A,z}}{\partial x_g^{SA,P}}x_h^{S,z}\right]=0
\end{aligned}$$

where we use $\lambda^{A,z}\hat{\lambda}^{S,z}$ as the notation for the multiplier on the budget constraints. To express things in terms of prices we use two envelope conditions:

$$\frac{\partial V^{S,P}(\bar{\mathbf{k}}^S,\mathbf{x}^{S,P})}{\partial x_g^{SA,P}} = \lambda^{S,P}p_g^{S,P} = \lambda^{S,P}q_g^{A,P}(1+t_g^{SA,P}) \tag{C.23}$$

$$\frac{\partial V^{A,P}(-\mathbf{x}^{S,P},\mathbf{k}^A(\mathbf{x}^{S,P}))}{\partial x_g^{SA,P}} = \lambda^{A,P}q_g^{A,P} \tag{C.24}$$

Substituting these expressions and dividing by $\theta^S \lambda^{S,P} q_g^{A,P}$ yields:

$$
\begin{aligned}
(1+t_g^{SA,P}) &= \frac{\theta^S \lambda^{A,P}}{(1-\theta^A)\lambda^{S,P}} \\
&\frac{\theta^S}{(1-\theta^A)\lambda^{S,P} q_g^{A,P}} \sum_{f\in\mathcal{F}} \left[\frac{\partial V^{A,C}(-\mathbf{x}^{S,P}, \bar{\mathbf{k}}^A(\mathbf{x}^{S,P}))}{\partial \bar{k}_f^A} - \frac{\partial V^{A,P}(-\mathbf{x}^{S,P}, \bar{\mathbf{k}}^A(\mathbf{x}^{S,P}))}{\partial \bar{k}_f^A} \right] \frac{\partial \bar{k}_f^A}{\partial x_g^{SA,P}} \\
&+ \sum_{z\in\{P,C\}} \frac{\lambda^{A,z} \hat{\mu}^{SA,z}}{(1-\theta^A)\lambda^{S,P} q_g^{A,P}} \left[q_g^{A,z} 1_{\{z=P\}} + \sum_{h\in\mathcal{G}} \frac{\partial q_h^{A,z}}{\partial x_g^{SA,P}} x_h^{SA,z} \right]
\end{aligned}
$$

There are three terms and it useful to simplify them one by one.

1. First one can show that:

$$
\begin{aligned}
&\frac{\theta^S \lambda^{A,P}}{(1-\theta^A)\lambda^{S,P}} + \frac{\lambda^{A,P} \hat{\mu}^{SA,P}}{(1-\theta^A)\lambda^{S,P} q_g^{A,P}} \left[q_g^{A,P} + \sum_{h\in\mathcal{G}} \frac{\partial q_h^{A,P}}{\partial x_g^{SA,P}} x_h^{SA,P} \right] \\
&= \frac{\lambda^{A,P}}{\lambda^{S,P}} \frac{\theta^S + \hat{\mu}^{SA,P}}{(1-\theta^A)} \left[1 + (1 - \frac{\theta^S}{\theta^S + \hat{\mu}^{SA,P}}) \sum_{h\in\mathcal{G}} \frac{\partial q_h^{A,P}}{\partial x_g^{SA,P}} \frac{x_h^{SA,P}}{q_g^{A,P}} \right]
\end{aligned}
$$

   This is done by multiplying and dividing by $q_g^{A,P}$ and adding and subtracting $\frac{\theta^S \lambda^{A,P}}{(1-\theta^A)\lambda^{S,P}} \sum_{h\in\mathcal{G}} \frac{\partial q_h^{A,P}}{\partial x_g^{SA,P}} \frac{x_h^{SA,P}}{q_g^{A,P}}$ to the left hand side. Rearranging yields the result.

2. Second we can show that

$$
\begin{aligned}
&\frac{\theta^S}{(1-\theta^A)\lambda^{S,P} q_g^{A,P}} \sum_{f\in\mathcal{F}} \left[\frac{\partial V^{A,C}(-\mathbf{x}^{S,P}, \bar{\mathbf{k}}^A(\mathbf{x}^{S,P}))}{\partial \bar{k}_f^A} - \frac{\partial V^{A,P}(-\mathbf{x}^{S,P}, \bar{\mathbf{k}}^A(\mathbf{x}^{S,P}))}{\partial \bar{k}_f^A} \right] \frac{\partial \bar{k}_f^A}{\partial x_g^{SA,P}} \\
&= \frac{\lambda^{A,P}}{\lambda^{S,P}} \frac{\theta^S + \hat{\mu}^{SA,P}}{(1-\theta^A)} \frac{\theta^S}{\theta^S + \hat{\mu}^{SA,P}} \sum_{f\in\mathcal{F}} \left[\frac{\bar{r}_f^{S,C}}{\bar{r}_f^{S,P}} - 1 \right] \left(\frac{\partial \bar{k}_f^A}{\partial x_g^{SA,P}} \frac{x_g^{SA,P}}{\bar{k}_f^A} \right) \left(\frac{r_f^{A,P} \bar{k}_f^A}{q_g^{A,P} x_g^{SA,P}} \right)
\end{aligned}
$$

   This result is obtained by using the envelope condition $\frac{\partial V^{A,z}(-\mathbf{x}^{S,P}, \bar{\mathbf{k}}^A(\mathbf{x}^{S,P}))}{\partial k_f^A} = \lambda^{A,z} r_f^{A,z}$ and subsequently multiplying and dividing by $x_g^{S,P}$,$r_f^{A,P}$ and $\bar{k}_f^A$ and $\theta^S + \hat{\mu}^{SA,P}$. Rearranging yields the result.

3. Lastly we can show that

$$
\frac{\lambda^{A,C} \hat{\mu}^{SA,C}}{(1-\theta^A)\lambda^{S,P} q_g^{A,P}} \left[\sum_{h\in\mathcal{G}} \frac{\partial q_h^{A,C}}{\partial x_g^{SA,P}} x_h^{SA,C} \right] = \frac{\lambda^{A,P}}{\lambda^{S,P}} \frac{\theta^S + \hat{\mu}^{SA,P}}{(1-\theta^A)} \left(\frac{\lambda^{A,C}}{\lambda^{A,P}} \frac{\hat{\mu}^{SA,C}}{\theta^S + \hat{\mu}^{SA,P}} \right) \left[\sum_{h\in\mathcal{G}} \frac{\partial q_h^{A,C}}{\partial x_g^{SA,P}} \frac{x_h^{SA,C}}{q_g^{A,P}} \right]
$$

   This result is obtained by multiplying and dividing by $\theta^S + \hat{\lambda}^{SA,P}$ and $\lambda^{A,P}$. Rearranging yields the result.

Collecting these results we obtain that

$$(1+t_g^{SA,P}) = \frac{\lambda^{A,P}}{\lambda^{S,P}}\frac{\theta^S+\hat{\mu}^{SA,P}}{1-\theta^A}\left[1+(1-\frac{\theta^S}{\theta^S+\hat{\mu}^{SA,P}})\sum_{h\in\mathcal{G}}\frac{\partial q_h^{A,P}}{\partial x_g^{SA,P}}\frac{x_h^{SA,P}}{q_g^{A,P}}\right]$$
$$+\frac{\lambda^{A,P}}{\lambda^{S,P}}\frac{\theta^S+\hat{\mu}^{SA,P}}{1-\theta^A}\left[\frac{\theta^S}{\theta^S+\hat{\mu}^{SA,P}}\sum_{f\in\mathcal{F}}\left[\frac{\bar{r}_f^{S,C}}{\bar{r}_f^{S,P}}-1\right]\left(\frac{\partial\bar{k}_f^A}{\partial x_g^{SA,P}}\frac{x_g^{SA,P}}{\bar{k}_f^A}\right)\frac{r_f^{A,P}\bar{k}_f^A}{q_g^{A,P}x_g^{SA,P}}\right]$$
$$+\frac{\lambda^{A,P}}{\lambda^{S,P}}\frac{\theta^S+\hat{\mu}^{SA,P}}{1-\theta^A}\left[\frac{\lambda^{A,C}}{\lambda^{A,P}}\frac{\hat{\mu}^{SA,C}}{\theta^S+\hat{\mu}^{SA,P}}\sum_{h\in\mathcal{G}}\frac{\partial q_h^{A,C}}{\partial x_g^{SA,P}}\frac{x_h^{SA,C}}{q_g^{A,P}}\right]$$

Quasi-linear special case When the good 0 is a natural numeraire good then

$$1-\theta^A-\theta^S=\lambda^{A,P}\hat{\mu}^{SA,P}$$

Define $\rho_{fg}^{SA}\equiv\frac{\partial\bar{k}_f^A}{\partial x_g^{SA,P}}\frac{x_g^{SA,P}}{\bar{k}_f^A}$ and $\mathcal{E}_g^{Sj,z_1z_2}=\sum_{h\in\mathcal{G}}\frac{\partial q_h^{j,z_1}}{\partial x_g^{Sj,z_2}}\frac{x_h^{Sj,z_1}}{q_g^{j,z_2}}$. Substituting and applying these definitions yields

$$t_g^{S,P}=\frac{1}{1-\theta^A}\left[\mathcal{E}_g^{SA,PP}+\theta^A\left(\mathcal{E}_g^{SA,PC}-\mathcal{E}_g^{SA,PP}\right)-\theta^S\left(\mathcal{E}_g^{SA,PC}-\mathcal{E}_g^{SA,PP}\right)+\theta^S\sum_{f\in\mathcal{F}}\left[\frac{\bar{r}_f^{S,C}}{\bar{r}_f^{S,P}}-1\right]\rho_{fg}^{SA}\frac{r_f^{A,P}\bar{k}_f^A}{q_g^{A,P}x_g^{SA,P}}\right]$$

General expression We can now define $\gamma^{SA,P}\equiv\frac{\theta^S}{\theta^S+\hat{\mu}^{SA,P}}$, $\psi^{SA}\equiv\frac{\lambda^{A,C}}{\lambda^{A,P}}\frac{\hat{\mu}^{SA,C}}{\theta^S+\hat{\mu}^{SA,P}}$ and $\frac{\lambda^{A,P}}{\lambda^{S,P}}\frac{\theta^A+\hat{\mu}^{SA,P}}{1-\theta^A}\equiv(1+\bar{t}^{SA,P})$. We also define $\rho_{fg}^{SA}\equiv\frac{\partial\bar{k}_f^A}{\partial x_g^{SA,P}}\frac{x_g^{SA,P}}{\bar{k}_f^A}$ and $\mathcal{E}_g^{Sj,z_1z_2}=\sum_{h\in\mathcal{G}}\frac{\partial q_h^{j,z_1}}{\partial x_g^{Sj,z_2}}\frac{x_h^{Sj,z_1}}{q_g^{j,z_2}}$. Applying these definitions yields

$$(1+t_g^{SA,P})=(1+\bar{t}^{SA,P})\left[1+(1-\gamma^{SA,P})\mathcal{E}_g^{SA,PP}+\gamma^{SA,P}\sum_{f\in\mathcal{F}}\left[\frac{\bar{r}_f^{S,C}}{\bar{r}_f^{S,P}}-1\right]\rho_{fg}^{SA}\frac{r_f^{A,P}\bar{k}_f^A}{q_g^{A,P}x_g^{SA,P}}+\psi^{SA}\mathcal{E}_g^{SA,PC}\right] \tag{C.25}$$

The term ψ^{SA} captures two different motives. The reason is that the multiplier during conflict contains both the defensive and offensive motive. This can be seen by rearranging the first order condition for trade during conflict to:

$$\lambda^{A,C}\hat{\mu}^{SA,C}\equiv\frac{\theta^A\frac{\partial V^{S,C}(\bar{\mathbf{k}}^S,\mathbf{x}^{S,C})}{\partial x_g^{SA,C}}+\theta^S\frac{\partial V^{A,C}(-\mathbf{x}^{S,P},\bar{\mathbf{k}}^A(\mathbf{x}^{S,P}))}{\partial x_g^{SA,P}}}{q_g^{A,C}\left[1+\mathcal{E}_g^{SA,CC}\right]}$$

Hence we can write:

$$\psi^{SA} = \frac{\theta^A \frac{\partial V^{S,C}(\bar{\mathbf{k}}^S, \mathbf{x}^{S,C})}{\partial x_g^{SA,C}} + \theta^S \frac{\partial V^{A,C}(-\mathbf{x}^{S,P}, \bar{\mathbf{k}}^A(\mathbf{x}^{S,P}))}{\partial x_g^{SA,P}}}{\lambda^{A,P}\left(\theta^S + \hat{\mu}^{SA,P}\right) q_g^{A,C}\left[1 + \mathcal{E}_g^{SA,CC}\right]}$$

Hence we define

$$\psi_{def}^{SA} \equiv \frac{\theta^A \frac{\partial V^{S,C}(\bar{\mathbf{k}}^S, \mathbf{x}^{S,C})}{\partial x_g^{SA,C}}}{\lambda^{A,P}\left(\theta^S + \hat{\mu}^{SA,P}\right) q_g^{A,C}\left[1 + \mathcal{E}_g^{SA,CC}\right]}$$

$$\psi_{off}^{SA} \equiv \frac{\theta^S \frac{\partial V^{A,C}(-\mathbf{x}^{S,P}, \bar{\mathbf{k}}^A(\mathbf{x}^{S,P}))}{\partial x_g^{SA,P}}}{\lambda^{A,P}\left(\theta^S + \hat{\mu}^{SA,P}\right) q_g^{A,C}\left[1 + \mathcal{E}_g^{SA,CC}\right]}$$

It is clear that $\psi_{def}^{SA} + \psi_{off}^{SA} = \psi^{SA}$ and $\psi_{off}^{SA} = 0$ when $\theta^S = 0$ and $\psi_{def}^{SA} = 0$ when θ^A. To obtain the result in the text we make this substitution and use Lerner symmetry to set $\bar{t}^{SA,C} = 0$. Rearranging yields the result.

D. Derivations for the various examples

This section provides the derivations for several examples not fully worked out in the body of the paper.

D.1 Investment in the capacity to substitute derivations

The Cobb-Douglas case We start with the simple Cobb-Douglas case. Output is given by

$$c_{gas}^{S,z} = \left(\left(k_{pipe}^{S,z}\right)^{\alpha}\left(x_{pipe}^{S,z}\right)^{1-\alpha}\right)^{v} + \left(\left(k_{term}^{S,z}\right)^{\alpha}\left(x_{term}^{S,z}\right)^{1-\alpha}\right)^{v} \tag{D.1}$$

The first order conditions with respect to capital and imports are given by:

$$p_{gas}^{S,z}\left(k_g^{S,z}\right)^{\alpha v-1}\left(x_g^{S,z}\right)^{(1-\alpha)v}\alpha v = r_g^{S,z} \tag{D.2}$$

$$p_{gas}^{S,z}\left(k_g^{S,z}\right)^{\alpha v}\left(x_g^{S,z}\right)^{(1-\alpha)v-1}(1-\alpha)v = p_g^{S,z} \tag{D.3}$$

Use the first order condition for imports to obtain:

$$x_g^{S,z} = \left(\frac{p_{gas}^{S,z}}{p_g^{S,z}}\left(k_g^{S,z}\right)^{\alpha v-1}(1-\alpha)v\right)^{\frac{1}{1-(1-\alpha)v}} \tag{D.4}$$

, substitute this into the first order condition for capital to obtain:

$$p_{gas}^{S,z}\left(k_g^{S,z}\right)^{\alpha v-1}\left(\frac{p_{gas}^{S,z}}{p_g^{S,z}}\left(k_g^{S,z}\right)^{\alpha v-1}(1-\alpha)v\right)^{\frac{(1-\alpha)v}{1-(1-\alpha)v}}(\alpha v)=r_g^{S,z} \tag{D.5}$$

We take ratio between peace and conflict to obtain the desired expression:

$$\frac{r_g^{S,C}}{r_g^{S,P}}=\left(\frac{p_{gas}^{S,C}}{p_{gas}^{S,P}}\right)^{1+\frac{(1-\alpha)v}{1-(1-\alpha)v}}\left(\frac{p_g^{S,P}}{p_g^{S,C}}\right)^{\frac{(1-\alpha)v}{1-(1-\alpha)v}}=\left(\frac{p_{gas}^{S,C}}{p_{gas}^{S,P}}\right)^{\frac{1}{1-(1-\alpha)v}}\left(\frac{p_g^{S,P}}{p_g^{S,C}}\right)^{\frac{(1-\alpha)v}{1-(1-\alpha)v}} \tag{D.6}$$

Substituting this into the optimal policy formula yields the desired result.

CES case Next I turn to general case with $\epsilon\leq 1$. Total consumption of gas is given by

$$c_{gas}^{S,z}=\sum_{g\in\{pipe,term\}}\left(\alpha\left(k_g^{S,z}\right)^{\frac{\epsilon-1}{\epsilon}}+(1-\alpha)\left(x_g^{S,z}\right)^{\frac{\epsilon-1}{\epsilon}}\right)^{\frac{\epsilon}{\epsilon-1}v} \tag{D.7}$$

The first order conditions for capital and imports are given by:

$$p_{gas}^{S,z}v\left(\alpha\left(k_g^{S,z}\right)^{\frac{\epsilon-1}{\epsilon}}+(1-\alpha)\left(x_g^{S,z}\right)^{\frac{\epsilon-1}{\epsilon}}\right)^{\frac{\epsilon}{\epsilon-1}v-1}(1-\alpha)\left(x_g^{S,z}\right)^{\frac{\epsilon-1}{\epsilon}-1}=p_g^{S,z} \tag{D.8}$$

$$p_{gas}^{S,z}v\left(\alpha\left(k_g^{S,z}\right)^{\frac{\epsilon-1}{\epsilon}}+(1-\alpha)\left(x_g^{S,z}\right)^{\frac{\epsilon-1}{\epsilon}}\right)^{\frac{\epsilon}{\epsilon-1}v-1}\alpha\left(k_g^{S,z}\right)^{\frac{\epsilon-1}{\epsilon}-1}=r_g^{S,z} \tag{D.9}$$

The expenditure share on imports in a sector g given by

$$\chi_{x,g}^{S,P}\equiv\frac{p_g^{S,P}x_g^{S,P}}{p_g^{S,P}x_g^{S,P}+r_g^{S,P}k_g^{S,P}}=\frac{(1-\alpha)\left(x_g^{S,P}\right)^{\frac{\epsilon-1}{\epsilon}}}{\alpha\left(k_g^{S,P}\right)^{\frac{\epsilon-1}{\epsilon}}+(1-\alpha)\left(x_g^{S,P}\right)^{\frac{\epsilon-1}{\epsilon}}} \tag{D.10}$$

where the expenditure share on capital is denoted by $\chi_{k,g}^{S,P}$. To find the effect of changes in import cost on the relative prices for capital goods I restate the first order conditions in the exact-hat form

$$\hat{p}_{gas}^{S}\left(\chi_{kg}^{S,P}\left(\hat{k}_g^S\right)^{\frac{\epsilon-1}{\epsilon}}+\chi_{xg}^{S,P}\left(\hat{x}_g^S\right)^{\frac{\epsilon-1}{\epsilon}}\right)^{\frac{\epsilon}{\epsilon-1}v-1}\left(\hat{x}_g^S\right)^{\frac{\epsilon-1}{\epsilon}-1}=\hat{q}_g^S \tag{D.11}$$

$$\hat{p}_{gas}^{S}\left(\chi_{kg}^{S,P}\left(\hat{k}_g^S\right)^{\frac{\epsilon-1}{\epsilon}}+\chi_{xg}^{S,P}\left(\hat{x}_g^S\right)^{\frac{\epsilon-1}{\epsilon}}\right)^{\frac{\epsilon}{\epsilon-1}v-1}\left(\hat{k}_g^S\right)^{\frac{\epsilon-1}{\epsilon}-1}=\hat{r}_g^S. \tag{D.12}$$

The first step to showing that Sovereign grants high subsidies to sectors that have the option to substitute it so show that $\frac{d\hat{r}_g^S}{d\hat{x}_g^S} > 0$. Differentiating Equation (D.12) and rearranging yields

$$\frac{d\hat{r}_g^S}{d\hat{x}_g^S} = \left(v - \frac{\epsilon - 1}{\epsilon}\right) \hat{p}_{gas}^S \left(\chi_{kg}^{S,P} + \chi_{xg}^{S,P} \left(\hat{x}_g^S\right)^{\frac{\epsilon-1}{\epsilon}}\right)^{\frac{\epsilon}{\epsilon-1}v-2} \tag{D.13}$$

where we used that $\hat{k}_g^S = 1$. This is positive whenever $v > \frac{\epsilon-1}{\epsilon}$ which holds for any $\epsilon < 1$.

The next step is to show that $\frac{d\hat{x}_g^S}{d\hat{q}_g^S} < 0$. Differentiating Equation (D.11) and rearranging yields

$$\frac{d\hat{q}_g^S}{d\hat{x}_g^S} = \left(\chi_{kg}^{S,P} + \chi_{xg}^{S,P} \left(\hat{x}_g^S\right)^{\frac{\epsilon-1}{\epsilon}}\right)^{\frac{\epsilon}{\epsilon-1}v-1} \left(\hat{x}_g^S\right)^{\frac{\epsilon-1}{\epsilon}-2} \left[\frac{\chi_{xg}^{S,P} \left(\hat{x}_g^S\right)^{\frac{\epsilon-1}{\epsilon}}}{\chi_{kg}^{S,P} + \chi_{xg}^{S,P} \left(\hat{x}_g^S\right)^{\frac{\epsilon-1}{\epsilon}}} \left(v - \frac{\epsilon-1}{\epsilon}\right) - \left(1 - \frac{\epsilon-1}{\epsilon}\right)\right] \tag{D.14}$$

Observe that $\frac{\chi_{xg}^{S,P} \left(\hat{x}_g^S\right)^{\frac{\epsilon-1}{\epsilon}}}{\chi_{kg}^{S,P} + \chi_{xg}^{S,P} \left(\hat{x}_g^S\right)^{\frac{\epsilon-1}{\epsilon}}} \in [0,1]$. Which implies the term between the brackets is negative. This implies that $\frac{d\hat{x}_g^S}{d\hat{q}_g^S} < 0$.

By combining the two results we see that capital prices decline relatively less for a sector that faces smaller price increases, provided that both sectors have the same expenditure shares at the baseline. Provided that the option to switch in equilibrium it follows that the import price increase for terminals is smaller than for pipelines. Since output prices enter both problems symmetrically it follows that the relative subsidy only depends on the component of hte capital price movemetn induced by changing import prices.

D.2 Demand for resilience and the argument for reshoring

I begin by stating the relevant equilibrium conditions of the economy in the example and then log-linearize them to derive the desired expressions.

Equilibrium conditions The consumer first order conditions imply

$$p_g^{S,z} = \left(c_g^{S,z}\right)^{-\frac{1}{\sigma_g}} \tag{D.15}$$

$$p_{Sg}^{S,z} c_{Sg}^{S,z} = \alpha_{Sg} p_g^{S,z} c_g^{S,z} \tag{D.16}$$

$$P_{\mathcal{J}g}^{S,z} c_{Jg}^{S,z} = \alpha_{\mathcal{J}g} p_g^{S,z} c_g^{S,z} \tag{D.17}$$

$$p_g^{S,z} = \frac{1}{\alpha_{Sg}^{\alpha_{Sg}} \alpha_{Jg}^{\alpha_{Jg}}} \left(p_{Sg}^{S,z}\right)^{\alpha_{Sg}} \left(P_{Jg}^{S,z}\right)^{\alpha_{Jg}} \tag{D.18}$$

The first order conditions for the firm imply

$$r_g^{S,z} = p_g^{S,z} \tag{D.19}$$

$$(D.20)$$

Two relevant market clearing conditions are

$$\bar{k}_g^S = k_g^{S,z} \tag{D.21}$$
$$c_{Sg}^{S,z} = y_{Sg}^{S,z} \tag{D.22}$$

Exact hat algebra First note that the consumer first order conditions imply

$$p_{Sg}^{S,z} y_{Sg}^{S,z} = \alpha_{Sg} p_g^{S,z} y_g^{S,z} = \alpha_{Sg} \left(p_g^{S,z}\right)^{1-\sigma_g} \tag{D.23}$$

Now use exact hat algebra to see that:

$$\begin{aligned}
\hat{p}_{Sg}^S \hat{y}_{Sg}^S &= \left(\hat{p}_g^S\right)^{1-\sigma_g} \\
\hat{p}_{Sg}^S \hat{y}_{Sg}^S &= \hat{r}_g^S \hat{k}_g^S \\
\hat{p}_g^S &= \left(\hat{p}_{Sg}^S\right)^{\alpha_{Sg}} \left(\hat{P}_{Jg}^S\right)^{\alpha_{Jg}} \\
\hat{r}_g^S &= \hat{p}_{Sg}^S \\
\hat{P}_{Jg}^S &= \left(\sum_{j \in \mathcal{J}} \chi_{jg}^S \left(\hat{q}_{jg}^j\right)^{1-\epsilon_g}\right)^{\frac{1}{1-\epsilon_g}}
\end{aligned}$$

Demand elasticity To derive the demand shift the above system is solved for $\hat{k}_g^S$ keeping $\hat{r}_g^S$ fixed. First observe that

$$\hat{P}_{Jg}^S = \left(\sum_{j \in \mathcal{J}} \chi_{jg}^S \left(\hat{q}_{jg}^j\right)^{1-\epsilon_g}\right)^{\frac{1}{1-\epsilon_g}} \implies \hat{P}_{Jg}^S = \left(1 - \sum_{j \in \mathcal{J}_D} \chi_{jg}^S\right)^{\frac{1}{1-\epsilon_g}}$$

where we use that $\left(\hat{q}_{jg}^j\right)^{1-\epsilon_g} \to 0$ as $\hat{q}_{jg}^j \to \infty$ Now combine the various expressions above to obtain

$$\hat{r}_g^S \hat{k}_g^S = \hat{p}_{Sg}^S \hat{y}_{Sg}^S = \left(\hat{p}_g^S\right)^{1-\sigma_g} = \left(\left(\hat{p}_{Sg}^S\right)^{\alpha_{Sg}} \left(\hat{P}_{Jg}^S\right)^{\alpha_{Jg}}\right)^{1-\sigma_g} = \left(\hat{r}_g^S\right)^{\alpha_{Sg}(1-\sigma_g)} \left(\hat{P}_{Jg}^S\right)^{\alpha_{Jg}(1-\sigma_g)}$$

Setting $\hat{r}_g^S = 1$ yields:

$$ln\hat{k}_g^S = \alpha_{Jg} \left(1 - \sigma_g\right) ln\hat{P}_{Jg}^S$$

Elasticity of demand Now use the same expression but set $\hat{q}_{jg}^{j} = 1$. This yields:

$$\hat{r}_g^S \hat{k}_g^S = \left(\hat{r}_g^S\right)^{\alpha_{Sg}(1-\sigma_g)} \implies \frac{ln\hat{k}_g^S}{ln\hat{r}_g^S} = \alpha_{Sg}\left(1-\sigma_g\right) - 1 \tag{D.24}$$

Solving for prices The expresion can also be used to solve directly for prices by imposing the market clearing condition for capital:

$$\left(\hat{r}_g^S\right)^{1-\alpha_{Sg}(1-\sigma_g)} = \left(\hat{P}_{Jg}^S\right)^{\alpha_{Jg}(1-\sigma_g)} \implies lnr_g^S = \frac{\alpha_{Jg}\left(1-\sigma_g\right) ln\hat{P}_{Jg}^S}{1-\alpha_{Sg}\left(1-\sigma_g\right)} = -\frac{DS_g^S}{EDFD_g^S} \tag{D.25}$$

E. Appendix to the quantitative exercise

E.1 Additional details of the setup and mapping

This section provides additional details on the setup and mapping between the quantitative partial equilibrium setup and the general model.

Trading partners The trading partners j are assumed to have preferences given by

$$u^{j,z} = c_0^{j,z} + \sum_{g \in \mathcal{G}_F} \left(a_{Sg}^j\right)^{-\frac{1}{\sigma}} \frac{\left(c_{Sg}^{j,z}\right)^{1-\frac{1}{\sigma}}}{1-\frac{1}{\sigma}} \tag{E.1}$$

where $\mathcal{G}_F$ refers to the aggregator sectors and Sg refers to Sovereign's variety associated with this sector. This implies that (61) can be derived from the household demand problem

$$\left(a_{Sg}^j\right)^{\frac{1}{\sigma}} \left(c_{Sg}^{j,z}\right)^{-\frac{1}{\sigma}} = p_{Sg}^j \implies x_{Sg}^{j,z} = c_{Sg}^{j,z} = a_{Sg}^j \left(p_{Sg}^{j,z}\right)^{-\sigma} = a_{Sg}^j \left((1+\tau_{Sg}^{j,z})p_{Sg}^{S,z}\right)^{-\sigma} \tag{E.2}$$

here good 0 is taken as the numeraire. There is a single capital variety that can used to produce the numeraire good and the varieties it sells to Sovereign

$$\bar{k}^j = c_0^{j,z} + \sum_{g \in \mathcal{G}_F} \frac{1}{b_{jg}^j} \frac{\left(y_{jg}^{j,z}\right)^{1-\omega}}{1-\omega}. \tag{E.3}$$

Equation (60) can be derived from the firm's maximization problem

$$p_{jg}^{j,z} \frac{1}{b_{jg}^j} \left(y_{jg}^{j,z}\right)^{-\omega} = 1 \implies p_{jg}^{j,z} = b_{jg}^j \left(y_{jg}^{j,z}\right)^{\omega} \tag{E.4}$$

E.2 Exact-hat algebra

E.2.1 Notation

Prices for Sovereign's domestic variety are given by

$$p_{Sg}^{S,z} = mc_{Sg}^{S,z} = \frac{1}{b_{Sg}\alpha_g^{\alpha_g}\left(1-\alpha_g\right)^{1-\alpha_g}}\left(r_g^{S,z}\right)^{\alpha_g}\left(P_{M,g}^{S,z}\right)^{1-\alpha_g} \tag{E.5}$$

where $mc_{Sg}^{S,z}$ is the marginal cost of a unit of output. The expenditure shares for intermediate goods in $M_g^{S,z}$ and foreign varieties in $X_g^{S,z}$ are respectively given by

$$\chi_{M,gh}^{S,z} \equiv \frac{P_{Y,h}^{S,z}M_{gh}^{S,z}}{\sum_{g\in\mathcal{G}_F}P_{Y,h}^{S,z}M_{gh}^{S,z}} \qquad \chi_{X,jg}^{S,z} \equiv \frac{p_{jg}^{S,z}x_{jg}^{S,z}}{\sum_{j\in\mathcal{J}}p_{jg}^{S,z}x_{jg}^{S,z}}. \tag{E.6}$$

The expenditure share of domestic varieties and the foreign aggregator in final output $Y_g^{S,z}$ are respectively given by

$$\chi_{D,g}^{S,P} \equiv \frac{p_{S,g}^{S,z}D_g^{S,z}}{p_{Sg}^{S,z}D_g^{S,z}+P_{Xg}^{S,z}X_g^{S,z}} \qquad \chi_{X,g}^{S,z} \equiv \frac{P_{X,g}^{S,z}X_g^{S,z}}{p_{Sg}^{S,z}D_g^{S,z}+P_{Xg}^{S,z}X_g^{S,z}} \tag{E.7}$$

The market clearing condition for domestic varieties is given by

$$y_{Sg}^{S,z} = D_g^{S,z} + \sum_{j\in\mathcal{J}}(1+\tau_{Sg}^{j,z})x_{Sg}^{j,z}. \tag{E.8}$$

Multiplying this by $p_{Sg}^{S,z}$ and substituting Equation (61) yields an expression for the revenue of a sector

$$R_g^{S,z} = p_{Sg}^{S,z}D_g^{S,z} + \sum_{j\in\mathcal{J}}\left(p_{Sg}^{S,z}(1+\tau_{Sg}^{j,z})\right)^{1-\sigma} \tag{E.9}$$

where $R_g^{S,z} \equiv p_{Sg}^{S,z}y_{Sg}^{S,z}$ denotes revenue in a sector. The market clearing condition for the final good is given by

$$Y_g^{S,z} = C_g^{S,z} + \sum_h M_{hg}^{S,z}. \tag{E.10}$$

To obtain an expression for sectoral expenditures first multiply by $P_{Y,g}^{S,z}$. The Cobb-Douglas assumption for consumer preferences implies that $P_{Y,g}^{S,z}C_g^{S,z} = \beta_g^S\left(I^{S,z}+TB^{S,z}\right)$ where $I^{S,z}$ is total income from factors and $TB^{S,z}$ is the trade balance condition. The Cobb-Douglas assumption on the production technology implies that the expenditure share is a constant fraction of revenue $P_{M,g}^{S,z}M_g^{S,z} = (1-\alpha_g)p_{Sg}^{S,z}y_{Sg}^{S,z} = (1-\alpha_g)R_g^{S,z}$. Using that $\chi_{M,hg}^{S,z} = \frac{P_{Y,g}^{S,z}M_{hg}^{S,z}}{\sum_{g\in\mathcal{G}_F}P_{Y,g}^{S,z}M_{hg}^{S,z}}$ the sectoral expenditure can be written as

$$E_g^{S,z} = \beta_g^S \left(I^{S,z} + TB^{S,z}\right) + \sum_{h\in\mathcal{G}_\mathcal{F}} \chi_{M,hg}^{S,z}(1-\alpha_g)R_g^{S,z} \tag{E.11}$$

where $E_g^{S,z} \equiv P_{Y,g}^{S,z}Y_g^{S,z}$ denotes expenditure on a sector. All income accrues to factors of production and hence

$$I^{S,z} = \sum_{g\in\mathcal{G}_\mathcal{F}} r_g^{S,z}\bar{k}_g^{S,z} = \sum_{g\in\mathcal{G}_\mathcal{F}} \alpha_g R_g^{S,z}. \tag{E.12}$$

E.2.2 Exact-hat algebra

Let v be some variable of interest, then $\hat{v} \equiv \frac{v^C}{v^P}$. The exception are iceberg costs where $\hat{\tau} \equiv \frac{1+\tau^C}{1+\tau^P}$.

The change in marginal cost is given by

$$\hat{p}_{Sg}^S = \hat{mc}_{Sg}^S = \left(\hat{r}_g^S\right)^{\alpha_g}\left(\hat{P}_{M,g}\right)^{1-\alpha_g} \tag{E.13}$$

The changes to the CES price indices for $M_g^{S,z}$, $X_g^{S,z}$ and $Y_g^{S,z}$ are respectively given by

$$\hat{P}_{M,g}^S = \left(\sum_{h\in\mathcal{G}} \chi_{M,gh}^{S,P}\left(\hat{P}_h^S\right)^{1-\epsilon}\right)^{\frac{1}{1-\epsilon}} \tag{E.14}$$

$$\hat{P}_{X,g}^S = \left(\sum_{j\in\mathcal{J}} \chi_{X,jg}^{S,P}\left(\hat{p}_{jg}^S\right)^{1-\eta_g}\right)^{\frac{1}{1-\eta_g}} \tag{E.15}$$

$$\hat{P}_{Y,g}^S = \left(\chi_{Y,D,g}^{S,P}\left(\hat{p}_{Sg}^S\right)^{1-\kappa} + \chi_{Y,X,g}^{S,P}\left(\hat{P}_{X,g}^S\right)^{1-\kappa}\right)^{\frac{1}{1-\kappa}}. \tag{E.16}$$

The changes to the expenditure shares are given by

$$\hat{\chi}_{M,gh}^{S,P} = \left[\frac{\hat{P}_{Y,h}}{\hat{P}_{M,g}}\right]^{1-\epsilon}, \quad \hat{\chi}_{X,j,g}^{S,P} = \left[\frac{\hat{p}_{j,g}^S}{\hat{P}_{X,g}^S}\right]^{1-\eta_g}, \quad \hat{\chi}_{D,g}^{S,P} = \left[\frac{\hat{p}_{S,g}^S}{\hat{P}_{Y,g}^S}\right]^{1-\kappa}, \qquad \hat{\chi}_{X,g}^{S,P} = \left[\frac{\hat{P}_{Xg}^S}{\hat{P}_{Y,g}^S}\right]^{1-\kappa}. \tag{E.17}$$

The changes to sectoral revenue are given by

$$\hat{R}_g^S R_g^{S,P} = \hat{\chi}_{D,gh}^S \chi_{D,gh}^{S,P} E_g^{S,P} + \sum_{j\in\mathcal{J}} R_g^{Sj,P}\left(\hat{mc}_{Sg}^S \hat{\tau}_{jg}^S\right)^{1-\sigma}. \tag{E.18}$$

where $R_g^{Sj,P} \equiv \left(p_{Sg}^{S,z}(1+\tau_{Sg}^{j,z})\right)^{1-\sigma}$ denotes the revenue obtain from selling to country j. The change to sectoral expenditure is given by

$$\hat{E}_g^S E_g^{S,P} = \beta_g^S \left(\hat{I}^S I^{S,P} + TB^S \right) + \sum_{h \in \mathcal{G}} \hat{\chi}_{M,hg}^S \hat{R}_g^S \chi_{M,hg}^{S,P} \left(1 - \alpha_g\right) R_g^{S,P}. \tag{E.19}$$

The change to total income is given by

$$\hat{I}^S = \sum_{g \in \mathcal{G}} \alpha_g \hat{r}_g^S R_g^{S,P} \tag{E.20}$$

The change in revenue equals the change in the prices of capital goods

$$\hat{R}_g = \hat{r}_g \tag{E.21}$$

E.3 Data

The system of equations given by (E.13)-(E.21) can be used to solve for $\hat{r}_g^S$. To be able to solve the system, data is needed to calibrate baseline various expenditure and revenue shares. Two different data sources are used for this purpose, the BEA-IO data and the Census trade data.

BEA-IO Data The BEA-IO data is used to obtain data for all expenditure shares to be calibrated except for import shares and export shares. This includes consumer expenditure shares, value-added shares, intermediate expenditure shares, and sector-level expenditures and revenues. The specific input-output table used is the detailed IO table provided at 5-year intervals by the BEA. The cross-sectional analysis of the paper relies on the 2017 IO table. The time series analysis in the paper relies on the data between 1997 and 2017.

Census Trade Data The trade data is used to calibrate import and export shares within a detailed BEA IO industry. The sample used covers the universe of trading partners for each of the years the IO table is available. The data used are the USD value of all imports and exports at the HS-6 level for the universe of trading partners. The data at the HS-6 level is used to compute import and export shares at the BEA IO level by linking HS-6 codes to the appropriate NAICS codes using the crosswalk provided by Pierce and Schott (2009).

E.4 Calibration

There are two sets of parameters that need to be calibrated to compute $\hat{r}_g^S$ using (E.13)-(E.21): various expenditure and revenue shares, and various elasticities.

The model only focuses on tradable sectors. All sectors that do not match to an HS-6 code and hence do not have associated import or export data are aggregated into a single non-tradable sector. The sectors are the most detailed ones provided in the BEA IO data, which vary between 4- and 6-digit NAICS codes. In 2017, the total number of sectors is 241.

Calibrating shares, revenues and expenditures The shares, revenues and expenditures to be calibrated are $\{\alpha_g, \beta_g, \chi^{S,P}_{M,gh}, \chi^{S,P}_{X,jg}, \chi^{S,P}_{D,g}, \chi^{S,P}_{X,g}, R^{S,P}_g, E^{S,P}_g, I^{S,P}, R^{S,P}_{jg}, TB^{S,P}\}$. All value added accrues to capital goods, and so α_g is calibrated to match the value-added share of a sector. Consumer expenditure shares β_g are calibrated to match final expenditure shares. Intermediate good shares $\chi^{S,P}_{M,gh}$ are calibrated based on the share of expenditure on a sector h as a fraction of all intermediate goods expenditure in a sector g. Import shares $\chi^{S,P}_{X,jg}$ are calibrated to imports from j in a sector g as a fraction of total imports in sector g. Expenditure shares on domestic goods $\chi^{S,P}_{D,g}$ and imports $\chi^{S,P}_{X,g}$ are respectively calibrated to match domestic expenditure and expenditure on imported goods at the sector level. Baseline $R^{S,P}_g$ and $E^{S,P}_g$ match the revenue and expenditure data at the sector level. Aggregate income $I^{S,P}$ matches aggregate income. Revenue export shares $R^{S,P}_{jg}$ are chosen to match export revenue attained by exporting to country j in a given sector. Trade balance $TB^{S,P}$ is chosen to match the trade balance.

All results that emphasize the cross section are based on the 2017 data. For the analysis over time, the calibration is repeated for each year the detailed IO tables are available.

Calibrating elasticities The elasticities to be calibrated are $\{\kappa, \eta_g, \epsilon, \sigma, \omega\}$. Here κ, σ and ω follows Fajgelbaum et al. (2020) and ϵ is based on Atalay (2017).

The main elasticity that needs further clarification is η_g. These are calibrated based on Broda and Weinstein (2006). They provide trade elasticities at both the 3-digit HS level for 73 countries and the more detailed SITC 5-digit level for the US. To obtain the trade elasticity, the SITC 5 codes are mapped to HS 6 codes using the crosswalk provided by World Integrated Trade Solution (WITS). A sector-level trade elasticity is then constructed by computing an import-share weighted average for each industry code. Since starting with the SITC 5 codes and the 3-digit HS code does not generally yield the same elasticity, an average between the two measures is taken to produce the sector-level trade elasticity. The resulting vector of trade elasticities has a mean of 7.13, a median of 3.12, and a standard deviation of 35.50.

E.4.1 Numerical implementation

To solve the system (E.13)-(E.21) the following algorithm is used.

1. Given that $\omega = 0$, compute $\hat{P}^S_{X,g}$ directly using (E.15)
2. Guess a vector $\hat{r}^S_{g,guess}$
3. Use $\hat{r}^S_{g,guess}$ and $\hat{P}^S_{X,g}$ to solve for $\hat{p}^S_{Sg}$, $\hat{P}^S_{Y,g}$ and $\hat{P}^S_{M,g}$ using (E.13), (E.14) and (E.16)

4. Solve for changes to expenditure shares in (E.17)

5. Solve for $\hat{R}_g^S$,$\hat{E}_g^S$ and $\hat{I}^S$ using (E.18)-(E.20).

6. Compute a new $\hat{r}_{g,new}^S$ using (E.21)

7. If max $\{\hat{r}_{g,new}^S - \hat{r}_{g,guess}^S\}$ exceeds a tolerance, update the guess using $\hat{r}_{g,new}^S$ and return to 2.

Once the system has been solved for $\hat{r}_g^S$ then $\frac{\bar{r}_g^{S,C}}{\bar{r}_g^{S,P}}$ can be computed by correcting changes in spot prices by changes in the marginal utility of income using

$$\frac{\bar{r}_g^{S,C}}{\bar{r}_g^{S,P}} = \frac{\hat{r}_g^S}{\Pi_{g\in\mathcal{G}_F}\left(\hat{P}_{Y,g}^S\right)^{\beta_g^S}} \tag{E.22}$$

E.5 Additional results

E.5.1 A Closer Look at Semiconductors

Semiconductors have been of particular policy interest in recent years, with the United States passing the CHIPS Act to build domestic capacity in this sector. The results in Table 2 suggest that semiconductors would indeed be the best sector to target with investment subsidies if the goal is to build resilience to a more minor conflict over Taiwan (Scenario 2), but it may not be as high of a priority for a larger conflict that also disrupts trade with China (Scenario 1).

This conclusion, however, relies on some limitations of the current exercise. First, a closer look at the semiconductor industry code (334413) reveals that it is a rather broad sector; it also includes photovoltaic cells, which are produced in China. As a result, the analysis may understate the importance of Taiwan in the sourcing of semiconductors. Second, no corrections were made for global value chains. Some of the United States' semiconductor imports do not come directly from Taiwan. Instead, Taiwanese chips are sent to Malaysia or Vietnam for testing and are then exported from those countries.

These factors suggest that the analysis may understate the importance of semiconductors. To get a sense of how things would change when addressing these two limitations, I updated the calibration to reflect some of the findings from a recent U.S. government report on U.S. exposure to the semiconductor industry (Jones et al. (2023)). This report attempts to correct for global supply chains and provides an estimate for logic chip imports specifically.[24] Logic chips are the chip seg-

[24] This is useful since there is an HTS code for memory chips, but logic and analog chips can be imported under several HTS codes.

ment in which Taiwan is especially prominent. The report's results are used to recalibrate import shares for the 334413 NAICS6 code. The results of the updated calibration are reported in Table 4.

Table 4: Rankings of semiconductors under alternative calibration of imports

	US Import Shares		Scenario 1: Taiwan+China		Scenario 2: Taiwan	
Calibration	China	Taiwan	Rank	Strategic Value	Rank	Strategic Value
Baseline	0.112	0.097	16	0.094	1	0.076
All Chips	0.054	0.193	11	0.144	1	0.190
All Chips GSC correction	0.135	0.265	5	0.416	1	0.297
Logic Chips	0.170	0.442	1	1.169	1	0.694

Note: Strategic values are reported for $\theta^A = 1$ and an iceberg cost shock of 10000 for each sector. All chips refers to logic, memory and analog chips.

The baseline case has a relatively low share of imports from Taiwan. However, once the calibration is specialized to focus solely on semiconductors rather than the entire industry, the share of Taiwanese imports doubles, while that of China is halved. Even with this adjustment, semiconductor imports are still understated, as the global supply chain (GSC) correction further increases the import shares of both Taiwan and China. This adjustment raises semiconductors to the 5th most strategic sector for the first scenario and significantly increases the strategic value of capital in the second scenario.

The final calibration is specifically tailored to logic chips, where Taiwan is especially dominant. This calibration is somewhat aggressive, as it narrows the focus to a relatively specific market segment. Nevertheless, the results are interesting because they suggest that the framework could potentially justify high subsidies (depending on θ^A) when focusing on narrow industries and making appropriate global supply chain corrections.

E.5.2 Different Cuts for the Strategic Value over Time

The analysis in Section 6.4.2 was done by taking the top 10 percent of sectors by strategic value in each year the BEA IO table is available and computing the average strategic value. Table 5 repeats the exercise but does so for different percentiles. The basic pattern of about a 6-fold increase in strategic value that closely traces the increase in expenditures on Chinese and Taiwanese imports is robust to changing the percentile threshold.

Table 5: Growth in Strategic Value Between 1997 and 2017

Percentile	ExpenditureShare	Strategic Value
5	7.299	6.829
10	6.309	6.201
25	5.125	5.910
50	5.697	5.943

Note: Index values reported for the year 2017 and are normalized relative to the year 1997 baseline.