Power and Resilience: An Economic Approach to National Security Policy

Olivier Kooi*

University of Chicago

December 22, 2024 – Version 1.1

JMP - Updated Frequently

For the latest version, click here

Abstract

This paper develops a theory of national security externalities based on the bargaining approach to conflict. Bargaining induces countries to value resilience to conflict because it improves bargaining outcomes. Resilience depends on economic decisions, such as investment and trade patterns, made by atomistic agents. The key assumption is that there is a missing market for bargaining power, which leads to a national security externality. The role for national security policy is to reduce the social cost of the national security externality by directly intervening in markets to affect the decisions that produce resilience. Various national security policies can be studied from this perspective. Examples developed in the 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 studies the value of reshoring productive capacity in a scenario where the US faces a potential conflict with China over Taiwan. The exercise identifies semiconductors as among the most valuable industries for reshoring. It also suggests the rise of China and corresponding expansion of trade increased the value of reshoring by over 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 study of the optimal design of national security policy - interventions in markets in support of national security - occupies a relatively small part of standard economic analysis. On the face of it, this neglect is surprising. National security is traditionally considered one of the premier responsibilities of the state, and most governments devote substantial resources to it. While the boundaries of economics as a field have expanded considerably in recent decades, the study of national security is notably absent from Edward Lazear's (Lazear (2000)) review of applications of economic imperialism.

The rise of China has put national security and great power politics at the top of the policy agenda. Recent events have reminded policy makers that national security is also very much an economic problem. The Ukraine war led to concerns that the defense industrial base had atrophied. The United States responded by developing the first-ever national defense industrial strategy. Similarly, the trade disruptions caused by the pandemic showed that the United States had become reliant for critical imports such as semiconductors on China and Taiwan. The United States responded by passing the CHIPS act to reshore semiconductor manufacturing capacity.

While the importance of economics to national security policy is now widely recognized, the policy discussion often does not rely on economists' traditional approach to policy prescription. The economic approach to policy prescription emphasizes that an argument for intervention in markets begins with an explanation of why those markets fail. This approach can be applied to national security policy as well. This is what a theory is needed for: to provide a framework that can explain why the reality of geopolitics can lead to a national security externality that causes markets to fail. A theory that can then guide national security policy by clarifying which policy instruments a nation should use and how it should target them to address the market failure.

This paper makes two contributions to the economic study of national security policy. It first builds on the bargaining approach to conflict to develop a theory of national security externalities. This externality implies that markets underprovide resilience to conflict, which then justifies policy interventions in markets to address this market failure. It then applies the theory to study a range of contemporary national security policies. These questions can be studied through the lens of the model, as they can be interpreted as interventions in markets aimed at increasing a country's resilience to conflict or reducing that of an adversary.

The bargaining approach to conflict is developed in Schelling (1960). The approach recognizes that in many potential conflict situations, even if parties compete over some fixed prize, there is also a common interest—to avoid the damages associated with conflict. That is, there is an incentive to bargain. This is true regardless of whether conflict takes the form of a war or a trade conflict.

The formal literature studying war as an equilibrium phenomenon builds on this idea. In an influential article, Fearon (1995) argues that a rationalist theory that can explain the puzzle of war—that they are costly but nevertheless do happen—is a theory that explains why bargaining fails to avoid it.[1]

The bargaining approach to conflict was applied by Thomas Schelling to national security questions such as strategic troop placement and nuclear strategy. One of the key insights of *Arms and Influence (1966)* is that, even in a world where bargaining is successful at avoiding war, military power is valuable. Arms produce influence; i.e., military power produces bargaining power.[2]

The argument of this paper is that the bargaining approach can also be applied to study the national security argument for interventions in markets. This argument is based on four premises. First, resilience also produces bargaining power. The lower the welfare loss caused by conflict, the more resilient a country is and the lower the price it is willing to pay to keep the peace. An adversary understands this and concludes that it must moderate demands to avoid conflict, improving one's bargaining outcomes. For example, if Britain had been better prepared for war, it may have been less costly to deploy some given amount of military power, thereby lowering the cost of war. This also applies to one's adversary: the less resilient it is, the more it is willing to concede to keep the peace, and the more that can be extracted from it.

Second, many economic decisions affect a country's resilience to conflict. An increase in investment in the industrial base may lower the cost of expanding weapons production during a war, thereby increasing resilience to such a conflict. Similarly, reshoring semiconductor manufacturing capacity may lower the cost of a conflict in which imports get disrupted, thereby increasing resilience to such a conflict.

Third, many economic decisions that affect a country's resilience to conflict are made by the private sector, not the governments that bargain. For example, a significant portion of the defense industrial base is privately owned and operated. Similarly, many import and investment decisions in the semiconductor industry are made by firms, not the government.

[1] Part of the reason that the bargaining view of conflict has been especially prominent in the study of war is that the outside option of fighting is particularly relevant in this context. The reason is that the international system is anarchic; there is no authority to enforce property rights between states. Successful states can use their monopoly on violence to enforce property rights domestically, but no such actor exists to perform this function between states within the international system. This is especially true for great powers, as smaller states may seek protection from larger ones. In an anarchic environment, might makes right, and war becomes a means of allocating resources or resolving disputes between states. While it may seem that life in such an environment is nasty, brutish, and short, the bargaining approach explains why this need not always be the case. Since war is an inefficient way of transferring resources, countries often resort to bargaining instead. Baliga and Sjöström (2013) point out that an anarchic environment can be stable if the conditions of the Coase Theorem apply.

[2] Bargaining in the shadow of war is often tacit; an example of more explicit bargaining might be the Munich Agreement. Chamberlain opted to pay the price for peace in his time, appeasing Hitler by conceding Czechoslovakia's territory, partly due to his belief that Britain was not prepared for conflict with the Axis powers (Taylor (1979)).

Fourth, and most fundamentally, there is a missing market for power. Consider the investment decision of a British weapons manufacturer in the years leading up to the Munich agreement. By investing slightly more, it receives the return on an additional unit of capital. However, it may also raise the country's resilience to an armed conflict. Suppose that Germany understands that Britain is more willing to go to war because of the investment and therefore it moderates it demands, thereby improving bargaining outcomes for the United Kingdom and leading to a welfare increase for British citizens. By the missing market premise I simply mean this does not contribute to the profits of the firm unless it is priced through the return on capital. The firm is effectively unable to exclude people from the benefits of the bargaining power it produced.[3]

Together, these four premises constitute a foundation of a theory of national security policy. According to the bargaining approach, a key feature of geopolitics is that the common interest to avoid the cost of conflict leads countries to bargain. On the one hand, bargaining lowers the value of resilience to conflict by driving down the probability that it occurs. On the other hand, it introduces a different source of social value for resilience because it improves bargaining power. Resilience is produced, in part, through economic decisions made by private sector agents. These agents ignore the effect of their decisions on resilience because there is no market for power that rewards them for their production of resilience. This leads to a national security externality. The role for national security policy is to reduce the social cost of the missing market for power by directly intervening in markets to affect the decisions that produce resilience.

This theory of the need for national security policy is the first main contribution of this paper. The second contribution is to show that this framework can be applied to study a range of contemporary national security policy questions. We will see that investment subsidies to the defense industrial base, the reshoring and friendshoring of productive capacity, and various ways to weaponize trade, including sanctions, can all be studied as optimal policy solutions to the national security externality. The reason is that all these policies can be interpreted as interventions in markets to manipulate resilience, either by increasing one's own or by reducing that of an adversary.

These two contributions are developed by studying optimal policy in a general equilibrium model with investment and trade, where countries bargain in the shadow of conflict. There are two countries, Sovereign and Adversary, who bargain over the allocation of some prize. If they agree on a split of the prize, there is peace; if they do not, there is conflict. Both conflict and peace are ways of splitting the prize. The difference between the two is that conflict is assumed to be costly.

[3]This premise does not rely on the assumption that the concessions the government obtains have a public goods component. This applies even if the concession the government obtains with the additional bargaining power itself is a good sold on markets. Suppose the government leverages the bargaining power to secure more widgets. In this case, the missing market premise also implies the firm does not own and get to sell those additional widgets; instead, the government gets to decide how they are allocated.

Conflict will be modeled as an adverse shock, such as an exogenous increase in wasteful defense expenditures.

I use this setup to study the strategic use of two policy instruments: (i) investment subsidies and (ii) trade taxes. Investment subsidies affect investment in capital. There is an irreversible investment in capital that must be made before bargaining. This implies that such investment affects bargaining power, and a government typically wants to intervene in it. Trade taxes affect the pattern of trade. A government can commit to trade taxes before bargaining and can condition them on the bargaining outcome (peace or conflict). We will see that a government will want to do so to obtain an advantage during the bargaining stage.

The first result on the use of policy instruments is that investment subsidies are used to increase domestic resilience to conflict. It is optimal to provide larger subsidies to capital goods whose prices appreciate more during conflict. The reason this increases resilience is that 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 produce high welfare during conflict relative to peace. This reduces the welfare difference between peace and conflict, thereby increasing resilience.

This first result is used to study the argument for subsidies to the defense industrial base and subsidies to reshore production capacity. The key insight is that these policies solve the same market failure; they just increase resilience for different conflict shocks. Subsidizing the defense industrial base makes one more resilient to the cost of raising military production during war.[4] Subsidizing domestic capacity makes a country more resilient to the cost of a trade disruption. The trade disruption may be caused by war, as would be the case for semiconductors if the U.S. and China went to war over Taiwan, or it may be caused by a trade conflict or even a country's own sanctions. Provided countries bargain in the shadow of such a conflict, this resilience would be valuable.

This first result is also used to study investment subsidies to capital goods used in different production technologies within the same sector. The key insight is that capital employed in technologies that have the capacity to adjust in response to conflict can be more valuable.[5] For example, optimal subsidies to the defense industrial base encourage investment in technologies that allow production to scale more in response to war.[6] Similarly, in an open economy, optimal subsidies

[4]A country's increased resilience may also make it more capable of "winning" the war. However, this outcome depends on how the country allocates its increased resilience. It may choose to trade off some resilience to boost military production. At the optimum, a country would be indifferent between reducing resilience—by lowering wartime consumption—and increasing military production. This paper elaborates on this trade-off through an extension, where the benefits of military production are modeled through a contest function, as in the standard guns-versus-butter models.

[5]These types of are investments are referred to in *The Economic Report of the President* (2022, p212) as investments in agility.

[6]The *National Defense Industrial Strategy* (2023,p.17) suggests providing additional funding aimed at developing flexible capacity.

encourage investment in technologies that allow one to substitute source countries. For instance, gas terminals may be preferred over pipelines because the former allows one to switch suppliers if the current supplier cuts exports, while the latter locks a country into the trading relationship.

This first result can also be used to study the argument for targeting specific sectors, such as why semiconductors may be a higher priority for reshoring than most. The theory highlights that these arguments are essentially about the shape of the derived demand curve for capital. The usual argument for subsidizing them goes something like this: semiconductors are a critical good (i.e., demand is inelastic), it is hard to substitute to other countries because they cannot ramp up production in the short run, and imports from Taiwan are large. These are all arguments for why the derived demand curve for capital in the semiconductor sector is both relatively inelastic and substantially shifts outward during a war with China over Taiwan. A large outward shift in demand, combined with relatively inelastic demand and a short-run inelastic supply of capital, implies that capital goods prices must appreciate to clear the market. The investment subsidies result then suggests they should be subsidized.

The second result on the use of policy instruments is that trade policy is used to bolster domestic resilience. This use of policy aims to manipulate trade patterns to shift the capital stock in other countries to obtain terms-of-trade gains during conflict, which then bolsters resilience.[7] Consider the case of semiconductors. A country anticipates that supply will be disrupted during a war over Taiwan and wants to use trade policy to increase resilience. It can do so by increasing imports from, say, South Korea during peace. This induces additional capital investment, which in turn pushes out the short-run cost curve. This lowers import prices during conflict (because capital is sticky), resulting in terms-of-trade gains and thereby bolstering resilience. These gains are larger the more one expects to import during conflict. Since it is presumably challenging to import from adversarial countries during conflict, this approach is particularly relevant for trade with friendly countries. This is the sense in which policy directs productive capacity toward allies, commonly referred to as friend-shoring in policy discussions.[8]

This second result also has an important corollary: trade policy is not used to protect domestic production capacity. There is a classical (going back to at least Smith (1776)) and still often-heard argument that suggests trade should be restricted if it weakens domestic capacity in sectors relevant to national security. Smith specifically supported the Navigation Acts to protect the shipping industry because it was important in war. The model is consistent with the premise that production

[7] Using trade policy to affect the allocation of capital in other countries is not the most efficient way of doing so. A more efficient thing to do would be to directly pay other countries to reallocate their capital stock. In Kooi (2024), I show that Sovereign would like to form an economic security union—an arrangement with other countries where it pays them to deviate from their comparative advantage in order to enhance resilience to trade disruptions.

[8] The *National Defense Industrial Strategy* (2023, p. 45) suggests friend-shoring to reduce reliance on adversarial or unstable nations.

capacity has strategic value but shows the conclusion does not follow. The reason is that it violates the targeting principle. If productive capacity is a government's concern, it is productive capacity that should be targeted—as directly as possible, through investment subsidies.[9]

The third result on the use of policy instruments suggests that trade policy can be employed to reduce Adversary's resilience. Within the model, there are three mechanisms for achieving this. The first mechanism proposes that trade policy can reduce Adversary's resilience by lowering trade taxes during peace and raising them during conflict. This approach increases Adversary's welfare during peace but decreases it during conflict, amplifying their welfare loss due to conflict and weakening their bargaining position. The paper interprets the increase in taxes during conflict as a form of sanctions—trade policy intended to punish.

The second mechanism suggested by the third result to lower Adversary's resilience involves manipulating trade during peace to affect Adversary's capital stock in a manner that generates terms-of-trade gains during conflict. This is beneficial not only because Sovereign values these terms-of-trade gains, but also because they come at Adversary's expense, thus reducing Adversary's resilience to conflict.

The final mechanism the third result proposes resembles a reverse investment policy. Sovereign uses trade to push Adversary's capital stock into sectors where the price of capital goods depreciates during conflict. This is a sector in which Sovereign would discourage domestic investment. The rationale behind this is similar to why investment subsidies might be advantageous for Sovereign. For example, consider Russia, which might sell gas cheaply to induce Germany to invest in an energy-intensive industry. This capital may become less valuable when conflict arises, and Germany's gas imports decline, thereby reducing Germany's resilience to conflict and strengthening Russia's bargaining position.

The final part of the paper returns to the study of the optimal patterns of investment through a quantitative exercise. An interesting feature of optimal subsidies is that they depend on the causal effect of conflict on capital goods prices. This has two key implications. First, optimal investment depends on the specific type of conflict to which Sovereign seeks to build resilience. Second, Sovereign needs to know a counterfactual to effectively target the policy. To operationalize the theory, the paper examines a specific conflict scenario and incorporates it into a quantitative trade model to quantify the effect of conflict on capital goods prices. The conflict scenario models a war between the U.S. (Sovereign) and China (Adversary) over Taiwan. It simulates two variants of this scenario: in the first, trade between the U.S., China, and Taiwan completely collapses; in the second, only trade between Taiwan and the U.S. collapses.

[9] As always, an argument that invokes the targeting principle relies on a sufficiently wide range of instruments being available.

The exercise identifies semiconductors as the most valuable sector for additional capital investment in the second scenario. Three factors favor semiconductors. First, semiconductors are primarily sold as intermediate inputs, which are harder to substitute in the model compared to final goods. Second, the sector-specific trade elasticity for semiconductors is low in the baseline calibration. Third, a relatively large part of U.S. semiconductor imports are from Taiwan. Another finding is that the rise of China and the corresponding expansion of trade have significantly increased the value of reshoring production. The marginal value of reshoring the most exposed sectors has risen more than fivefold between 1997 and 2017.

Related Literature This paper builds on the bargaining approach to conflict, which was developed and applied by Schelling (1960) and Schelling (1966) to questions such as nuclear strategy. The literature studying war uses models of bargaining failure to understand war. In an influential article, Fearon (1995) argues that to explain the central puzzle of war—that it is costly but nonetheless occurs in equilibrium—requires some type of bargaining failure, such as asymmetric information or limited commitment. A large literature has built on this idea to study various aspects of war. Some work that is especially related to the present paper is by 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.

This paper contributes to the literature studying interventions in markets in support of national security. One of the policies studied in this paper is subsidies to the defense industrial base to enhance resilience. An altogether different argument for such subsidies is developed by Thompson (1979), who shows they may be valuable when wartime price controls lead to underinvestment in the defense industrial base.[10] This paper finds that a government may want to subsidize more scalable technologies. The idea that countries may want to invest in the capacity to absorb shocks is discussed by Murphy and Topel (2013), though they do not study why competitive markets not do lead to optimal investments. Acemoglu et al. (2012) study optimal resource extraction taxes in a model of resource wars. They emphasize limited commitment rather than bargaining power as the rationale for policy intervention.

The main type of conflict studied in this paper is war. Another literature studies trade conflict rather than military conflict as the threat point in bargaining. The classic reference is Hirschman (1945), who points out that even if war is ruled out, countries can still trade threats to strengthen their hand in bargaining. Hirschman calls this the influence effect of international trade. A more

[10]Since this paper studies investment subsidies, it is related to the literature on industrial policy. It is reviewed by Juhász et al. (2023), Lane (2020), and Harrison and Rodríguez-Clare (2010). This paper is most closely related to a series of recent papers studying how a central planner would use industrial policy to alleviate frictions associated with financial market imperfections or scale economies (e.g., Itskhoki and Moll (2019), Liu (2019), Bartelme et al. (2019), Lashkaripour and Lugovskyy (2022)).

modern treatment is given by McLaren (1997), who provides a formal model that produces dependency by combining bargaining with an irreversible investment decision in capital. More recently, Liu and Yang (2024) incorporate bargaining in a model of trade to create a measure of international power.

There has been a renewed interest in economic statecraft—the study of how a country can leverage its economy to strengthen itself in diplomacy. Baldwin (1985) synthesizes and expands on many issues discussed in the earlier literature.[11] Partly in response to China's Belt and Road initiative, interest in these issues grew with contributions by Blackwill and Harris (2016) and Farrell and Newman (2019). Economists who recently took up these issues with a focus on optimal policy design include Clayton et al. (2023), Clayton et al. (2024), and Becko and O'Connor (2024). The former two papers focus on a framework with incomplete contracts between firms to model how states can leverage an economy to exert power. 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 during geopolitical conflict. In their baseline model, there is no role for investment policy.[12] Their baseline open economy environment is a two-country model, and so the friendshoring result in this paper is not developed there. While Becko and O'Connor (2024) emphasizes how trade can be weaponized, the emphasis of this paper lies on how policy is used to increase domestic resilience. The difference in the quantitative exercise reflects this difference in emphasis. 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 between studies. In this paper, sanctions increase bargaining power by reducing an adversary's resilience to conflict. In Osgood (1957) they reduce an adversary's military expenditure, while in Sturm (2022) a country is assumed to have preferences for hurting another country. Alekseev and Lin (2024) study the use of trade policy to raise an adversary's cost of producing military goods.[13]

This paper develops an argument for the use of policy 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) studies optimal policy to enhance resilience in supply chains. The role of policy in these papers is to alleviate frictions that originate in supply chain formation rather than in geopolitics.

Outline The paper is structured as follows. Section 2 presents a simple closed-economy version of the model to develop the idea that national security policy intervenes in markets to enhance

[11]This includes some 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.

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

[13]The economics literature on sanctions has expanded substantially after the Russian invasion of Ukraine. It is reviewed by Morgan et al. (2023). Some of the work includes Bianchi and Sosa-Padilla (2023) and De Souza et al. (2024).

resilience, in order to mitigate the national security externality. Subsequent sections extend this framework to examine specific national security policy issues. Section 3 generalizes the closed economy and applies it to study investment in scalable technologies. Section 4 sets up the open-economy version of the model. Section 5 studies investment and trade policies aimed at increasing Sovereign's resilience, while Section 6 studies how trade can be weaponized to reduce Adversary's resilience. Section 7 presents the quantitative exercise. Section 8 concludes.

2. National Security Externalities

This section shows how bargaining interacts with the missing market for power to create a national security externality. It presents a simple model where conflict takes the form of an increase of wasteful military expenditure. The economic decision of interest is the investment in capital made before bargaining. It begins in Section 2.1 by studying the economy from the perspective of the planner. This allows for a statement of the planning problem: how to optimally allocate investment when resilience to conflict is valuable. Section 2.2 describes the competitive equilibrium. Section 2.3 explains why the competitive equilibrium is inefficient in the absence of policy and how investment subsidies can be used to restore efficiency. Section 2.4 discusses two extensions of the bargaining environment.

2.1 Bargaining and the Problem of the Government

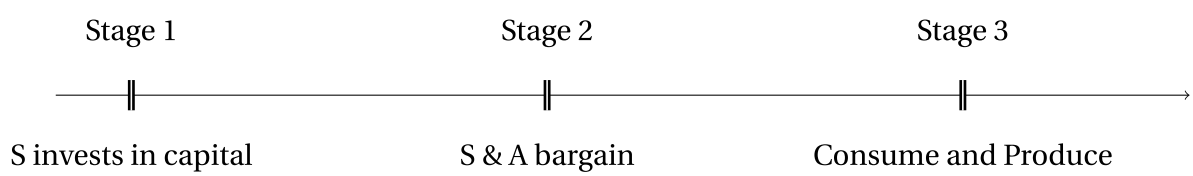
This section introduces a model of bargaining and investment from the planner's perspective. It formalizes the first two premises of the paper; (i) bargaining induces countries to value resilience, as it increases bargaining power and (ii) resilience is produced by economic decisions.

There are two countries, Sovereign and Adversary, denoted by $i \in \{S, A\}$. They are closed economies inhabited by a representative agent. There are two market goods, $g \in \{0, 1\}$, that are produced using sector-specific capital. The countries bargain over the division of some prize (labelled the bargaining good) that is in fixed supply. 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 $z \in \{P, C\}$. Fighting takes the form of an exogenous increase in wasteful defense output. The main economic decision of interest is an irreversible investment in sector-specific capital *before* bargaining occurs. We will see that the irreversibility implies that this investment affects outcomes during the bargaining stage.[14]

[14]The shock to defense output implies that the optimal allocation of capital ideally differs between peace and conflict. The idea that part of the cost of conflict arises from the interaction between the change in demand caused by conflict and the stickiness of capital is discussed by David Ricardo (Ricardo (1821)).

The timing of the economy is as follows. During Stage 1 Sovereign invests in capital (Adversary's capital stock is, for now, taken as given). In Stage 2 the parties bargain, this determines z and the split of the bargaining good. Bargaining is assumed to be efficient and since conflict destroys surplus there is peace along the equilibrium path. The split of the bargaining good, denoted by $B^{i,z}$, is assumed to follow the generalized Nash bargaining solution during peace. In Stage 3, once z is determined, the capital stock is used to produce output that used for consumption and defense expenditure.[15]

Figure 1: Timing of the economy



Here I study Sovereign's best response to Adversary's stage 1 capital stock allocation rather than a full Nash equilibrium. The reason is that this paper focuses on optimal policy prescription in a strategic environment. A Nash equilibrium would be appropriate if the paper aimed to provide a positive explanation for the policies followed by governments.[16]

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

[15]Countries have an incentive to bargain prior to Stage 1 to avoid the costs associated with inefficient capital investment. However, this is ruled out by assumption—a standard approach in gun versus butter models, which exclude arms agreements and similar arrangements. This assumption aligns with the observation that countries invest substantial resources in their military, even though they would presumably prefer to bargain and agree on reduced spending.

[16]The study of the strategy of conflict often emphasizes Nash equilibria because the modeler seeks to explain real-world phenomena. For example, Fearon (1995) addresses the war puzzle by clarifying what assumptions are needed for war to be a Nash equilibrium outcome in a bargaining game. Schelling (1960) highlights 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. Since national security policy prescriptions involve advising an actor within a strategic environment on how to "win," this paper focuses on Sovereign's best responses rather than on a Nash equilibrium. Dixit (2006) views this shift in emphasis (from positive to prescriptive) as one of Schelling's most fundamental contributions to traditional game theory. Schelling introduces the idea of a strategic move—actions taken prior to a subsequent game to alter the available strategies, information structure, or payoffs of that game. The approach taken here—studying Sovereign's best response while taking Adversary's investment as given—is similar.

domestic household. Their preferences are given by

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

The linearity of the bargaining good means utility is transferable, which means that efficiency and surplus maximization coincide. Later we will see it is also special in the sense that it does not enter the household budget constraint. This is useful because it allows for income effects while also allowing for transferable utility. None of the key insights rely on this assumption; everything would go through if B were traded on markets. The quasi-linearity of u^i eases exposition but is relaxed later.

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

$$y_g^{i,z} = F_g^i(k_g^{i,z}) \tag{1}$$

$$y_g^{i,z} = c_g^{i,z} + d_g^{i,z} \tag{2}$$

$$k_g^{i,z} = \bar{k}_g^i. \tag{3}$$

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

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

This is referred to as stage 3 welfare (since $B^{i,z}$ is determined in stage 2). At this stage, this is a trivial maximization problem since consumption is pinned down by the constraint in (1)-(3) alone. We will later see that this approach of absorbing various technology and market clearing conditions into a value function will extend to much richer economies also. I will often omit capital as an argument from the notation when it does not cause confusion.

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:

$$B^{S,z} + B^{A,z} = \bar{B}. \tag{4}$$

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

$$V^{S,P} + V^{A,P} > V^{S,C} + V^{A,C}. \tag{5}$$

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.

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

$$R^i \equiv V^{i,C} - V^{i,P} \tag{6}$$

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

$$\begin{aligned}(B^{S,P}, B^{A,P}) \in \text{argmax} & \left(B^{S,P} - R^S - B^{S,C}\right)^{\theta^S} \left(B^{A,P} - R^A - B^{A,C}\right)^{\theta^A} \\ \text{subject to} & \quad (4)\end{aligned}$$

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,

$$\begin{aligned} B^{S,P} &= \theta^A R^S - \theta^S R^A + B^{S,C} & (7) \\ &= \theta^A \left(V^{S,C} - V^{S,P}\right) - \theta^S \left(V^{A,C} - V^{A,P}\right) + B^{S,C}. & (8) \end{aligned}$$

A similar expression can be derived in other bargaining environments. For example, an ultimatum game where Sovereign makes an offer to Adversary with probability θ^S, and Adversary makes an offer to Sovereign with probability θ^A, yields an identical expression in expectation.

Power and the Demand for Resilience Equation (7) captures the first central premise of this paper: resilience produces bargaining power. Substituting equation (7) and (8) into the utility function leads to a simple expression for welfare,

$$\begin{aligned} W^S &= V^{S,P} + \theta^A R^S - \theta^S R^A + B^{S,C} &(9)\\ &= V^{S,P} + \theta^A (V^{S,C} - V^{S,P}) - \theta^S (V^{A,C} - V^{A,P}) + B^{S,C}. &(10) \end{aligned}$$

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.[17]

2.1.3 Stage 1: Investing in Capital

In stage 1, Sovereign chooses how to allocate capital between the two sectors. Sovereign takes Adversary's allocation of capital as given when making its decision.

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,

$$\bar{k}^i_0 + \bar{k}^i_1 = \bar{k}^i. \tag{11}$$

The problem of the government 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

$$\max_{\bar{k}^S_0, \bar{k}^S_1} \quad V^{S,P}(\bar{k}^S_0, \bar{k}^S_1) + \theta^A \left(V^{S,C}(\bar{k}^S_0, \bar{k}^S_1) - V^{S,P}(\bar{k}^S_0, \bar{k}^S_1) \right) + \mathcal{Z} \qquad \text{subject to (11)} \tag{12}$$

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

[17] The notion that states may have other-regarding preferences has long been discussed in international relations literature. This is typically framed as a debate between whether states maximize absolute gains (represented here as $V^{S,P}$) or gains relative to their adversaries (represented by the $V^{A,z}$ terms). A point made by Powell (1991) is that the relative gains consideration should not be taken as reflecting fundamental preferences, but instead should be derived from the desire for power arising from the anarchic environment of the international system. Equation (10) shows that this model captures this notion in an, admittedly, rudimentary way.

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

$$\frac{\partial V^{S,P}(\bar{k}_0^S, \bar{k}_1^S)}{\partial \bar{k}_g^S} + \theta^A \left(\frac{\partial V^{S,C}(\bar{k}_0^S, \bar{k}_1^S)}{\partial \bar{k}_g^S} - \frac{\partial V^{S,P}(\bar{k}_0^S, \bar{k}_1^S)}{\partial \bar{k}_g^S} \right) = \hat{\mu}^S \tag{13}$$

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. This second term is what Schelling (1960) referred to as a strategic move: "A strategic move is one that influences the other person's choice in a manner favorable to one's self, by affecting the other person's expectations of how one's self will behave." The generalized Nash bargaining solution in (7) captures this intuition in a reduced-form way: if one is more resilient to conflict, another actor has to moderate demands to obtain agreement.

2.1.4 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 and instead, bargaining was imposed directly. This simplifies exposition while still capturing the key premise: bargaining induces countries to value resilience.

We will often be flexible in relating the bargaining model to real-world examples. For instance, when interpreting the bargaining good as territory, I do not necessarily imply that the parties bargaining formally own the 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.

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

$$\left(c_0^{i,z}, c_1^{i,z}\right) \in \text{argmax}\left\{ B^{i,z} + u^i(c_0^{i,z}, c_1^{i,z}) \middle| \sum_{g\in\{0,1\}} p_g^{i,z} c_g^{i,z} + T^{i,z} = \Pi^{i,z} \right\} \tag{14}$$

$$\left(y_g^{i,z}, k_g^{i,z}\right) \in \text{argmax}\left\{ p_g^{i,z} y_g^{i,z} - r_g^{i,z} k_g^{i,z} \middle| y_g^{i,z} = F_g^i(k_g^{i,z}) \right\} \tag{15}$$

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:

$$\Pi^{i,z} = \sum_{g\in\{0,1\}} \left(p_g^{i,z} y_g^{i,z} - r_g^{i,z} k_g^{i,z}\right) + \sum_{g\in\{0,1\}} r_g^{i,z}(1+s_g^i)\bar{k}_g^i \tag{16}$$

$$T^{i,z} = \sum_{g\in\{0,1\}} r_g^{i,z} s_g^i \bar{k}_g^i + \sum_{g\in\{0,1\}} p_g^{i,z} d_g^{i,z} \tag{17}$$

I will sometimes refer to a stage 3 competitive equilibrium, which is defined as:

Definition 1 (A stage 3 competitive equilibrium)**.** *Given subsidies* $\{s_g^i\}$*, a state of geopolitics* z*, and a supply of capital* $\{\bar{k}_g^i\}$*, a competitive equilibrium consists of prices* $\left\{p_g^{i,z}, r_g^{i,z}\right\}$*, an allocation of capital, consumption, and production* $\left\{k_g^{i,z}, c_g^{i,z}, y_g^{i,z}\right\}$*, and a lump-sum transfer* $T^{i,z}$ *that satisfy* (1)-(3) *and* (14)–(17).

2.2.2 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;

$$\left(\bar{k}_0^i, \bar{k}_1^i\right) \in \operatorname{argmax} \left\{ \sum_{g \in \{0,1\}} r_g^{i,P}(1+s_g^i)\bar{k}_g^i | \bar{k}_0^i + \bar{k}_1^i = \bar{k}^i \right\}. \tag{18}$$

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* (14)–(18)

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 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:

$$r_g^{S,P} = \mu^S \tag{19}$$

where μ^S is the multiplier on the investment constraint for the firm in (14). 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

([12](#)). This yields:

$$\frac{\partial u^{S,z}}{\partial c_g^{S,z}} = p_g^{S,z} \quad , \quad p_g^{S,z} \frac{\partial F_g^{S,z}}{\partial k_g^{S,z}} = r_g^{S,z} \quad \text{and} \quad \frac{\partial V^{S,z}}{\partial \bar{k}_g^S} = \frac{\partial u^{S,z}}{\partial c_g^{S,z}} \frac{\partial F_g^{S,z}}{\partial k_g^S} \tag{20}$$

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:

$$\frac{\partial V^{S,z}}{\partial \bar{k}_g^S} = r_g^{S,z}. \tag{21}$$

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:

$$\left(\bar{k}_0^S, \bar{k}_1^S\right) \in \text{argmax} \left\{ B^{S,P} + V^{S,P}(\bar{k}_0^S, \bar{k}_1^S) | \bar{k}_0^S + \bar{k}_1^S = \bar{k}^S \right\} \tag{22}$$

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.

The reason for the difference is that there is effectively a missing market for bargaining power. This can be seen from the investment firm's profit maximization problem (18). Even though its investment produces both capital goods and bargaining power, only the value of the former is reflected in prices. The government uses bargaining power to obtain more bargaining goods, but the firm does not get compensated for these benefits. It can neither sell the resilience to the government before it bargains, nor charge consumers for the additional bargaining goods afterwards. Bargaining power is effectively non-excludable from the perspective of the firm. Also observe that when $\theta^A = 0$, the allocations resulting from (22) would coincide with the government problem, and there would be no national security externality. There would still be a missing market for power, but bargaining power is unaffected by resilience, and hence the first premise would not apply.

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:

$$r_g^{S,P}(1 + s_g^S) = \mu^S. \tag{23}$$

To solve for the optimal subsidies, I combine the government's and investment firm's first-order conditions with (21). In this case, the optimal subsidies can be written as:

$$s_g^S = \theta^A \left(\frac{r_g^{S,C}}{r_g^{S,P}} - 1 \right). \tag{24}$$

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 (21). We will later see that this expression generalizes with only minor changes to more complex economies. It will, therefore, be the starting point for a discussion of a wide range of national security policies in the paper.

The expression for optimal subsidies can also be derived graphically. Suppose that the production technology for good 0 is linear in capital. In this case, the opportunity cost of capital for sector 1 is constant, leading to a linear long run supply curve. By long run, I refer to the Marshallian notion in which capital adjusts flexibly. Observe that the supply of capital by the investment firm is perfectly elastic with respect to $r_1^{S,P}$. However, once a country reaches stage 3, capital is perfectly inelastic. The capital stock in an equilibrium without subsidies, $k_g^{S,CE}$, lies at the intersection of the long-run (peace) supply and demand curves, as depicted in Figure 2. The optimal capital stock, $k_g^{S,*}$, lies at the intersection of the long-run supply curve and the social demand curve that takes into account the strategic value of capital. This curve lies in between the peace and conflict stage 3 demand curves.

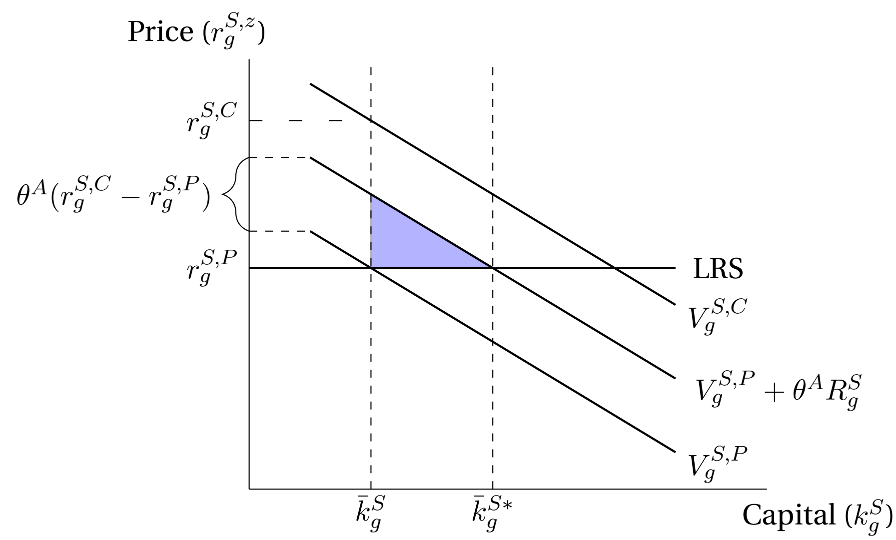


Figure 2: The cost of underinvestment in sector 1

The first insight in Figure 2 is 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 (24).

The second insight of Figure 2 is that while optimal subsidies only depend on a sufficient statistic involving prices, a strategist may not be able to directly observe the change in prices caused by conflict. The role of bargaining is after all to avoid conflict. This means a strategist has to think through the fundamentals (supply and demand) to predict price changes. The figure provides a straightforward answer as to when a sector should be targeted more during a given conflict: the farther the conflict pushes out the demand for capital, the higher the subsidy must be. The harder it is to substitute away from the use of the capital good, the steeper the demand curve is, and the larger the subsidy should be, provided that demand is pushed outward.

Much of the remainder of the paper will focus on applications of (generalized versions of) equation (24) to various policy questions. Discussions of investment in scalable technologies, reshoring productive capacity, the argument for targeting semiconductors, and investment in technologies that allow for substitution will all be based on equation (24). At their core, all these examples are discussions of how economic fundamentals affect the derived demand curve for capital in that sector.

2.4 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.

2.4.1 Asymmetric Information

So far bargaining has been assumed to be efficient and therefore avoided conflict in equilibrium. In this section I extend the bargaining environment to allow conflict to occur in equilibrium. I do so by introducing asymmetric information which is discussed by Fearon (1995) as one of the main explanations for the war puzzle. The basic insight - subsidies target capital goods that appreciate in price - from equation (24) is robust to the introduction of asymmetric information but interestingly optimal subsidies are reduced when conflict occurs in equilibrium.

Bargaining during stage 2 now takes the form of an ultimatum game. Adversary suggests a split of the bargaining good with probability θ^A and vice versa with θ^S. If the other party accepts the split there is peace, otherwise there is conflict. In the case of complete information this game leads to an (expected) $B^{i,P}$ that is identical to the generalized Nash bargaining outcome. Uncertainty is introduced by letting the party that receives the ultimatum draw an additive preference shock over the cost of conflict. The full setup with asymmetric information is somewhat involved and therefore relegated to Appendix A.1. With asymmetric information bargaining can fail in equilibrium. The conditional probability of a state z when a player i makes an offer is denoted by $\mathcal{P}^{i,z}$. The probability of a state z occurring is then denoted by $\mathcal{P}^z = \theta^S\mathcal{P}^{S,z} + \theta^A\mathcal{P}^{A,z}$.

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

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

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.

This is related to a more general point. 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.[18] What was the price of the peace? A low probability does not imply that there is little need for

[18] This point may be particularly relevant in the context of European dependency of 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.

national security policy; equation 25 actually suggests the opposite.

2.4.2 Arms, Influence, and the Theory of Public Expenditure

This paper began by pointing out that one of the key insights found 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. 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.[19] [20]

The contest function takes defense production $d_1^{i,C}$ as an input and determines the split of the bargaining good during peace. The simple contest function used here is

$$B^{S,C} = H^S(d_1^{S,C}, d_1^{A,C}) = \frac{d_1^{S,C}}{d_1^{S,C} + d_1^{A,C}} \bar{B} \tag{26}$$

where we assume that $d_1^{A,C} > 0$. All bargaining goods that do not go to Sovereign are allocated to Adversary. We allow Sovereign to commit to defense production before bargaining. Hence, we generalize the stage 3 welfare condition 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

$$\begin{aligned} \max_{\bar{k}_0^S, \bar{k}_1^S, d_1^{S,z}} \quad & V^{S,P}(\bar{k}_0^S, \bar{k}_1^S, d_1^{S,P}) + \theta^A \left(V^{S,C}(\bar{k}_0^S, \bar{k}_1^S, d_1^{S,C}) - V^{S,P}(\bar{k}_0^S, \bar{k}_1^S, d_1^{S,P}) \right) + H^S(d_1^{S,C}, d_1^{A,C}) + \mathcal{Z}_1 \\ & \text{subject to (11) and } d_1^{S,z} \geq 0 \end{aligned}$$

where $\mathcal{Z}_1 \equiv \theta^S \left(V^{A,C} - V^{A,P} \right)$. This maximization problem leads to a few insights. First, since a government is allowed to commit to defense production, the optimal subsidy is still given by (24). The reason is that subsidies were derived for a given increase in defense expenditures; the above model simply provides a microfoundation for the shift in defense expenditures. Second, it shows

This argument fails to ask what Germany had to give up to ensure it did.

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

[20]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—good 1 in the present model—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, $R^S = V^{S,C} - V^{S,P}$, unaffected. The assumption that good 1 can also be consumed introduces an opportunity cost that allows investment in the defense sector to affect resilience.

that the production of defense goods during peace, $d_1^{S,P}$, has no value and should therefore be minimized.

These two points imply that the optimal public expenditure on defense during peace looks quite different from what a standard public goods interpretation of national defense à la Samuelson (1954) might have suggested. Since it is optimal to set $d_1^{S,P} = 0$, optimal defense expenditure during peace is given by the expenditure on subsidies to the defense industrial base, $r_1^{S,P}\bar{k}_1^S s_1^S$.[21] Optimal public expenditure during peace takes the form of investment that lowers the cost of military production during conflict. [22]

2.4.3 Rising Great Powers and the Role of the Status Quo

Times when a new great power rises can be turbulent within the international system. One reason is that the distribution of political concessions may reflect an old status quo that no longer corresponds to the relative military strength and resilience of the two great powers. This means that the rising power may have an incentive to engage in war to alter the status quo.[23]

The model developed so far does not capture this type of consideration. The maintained assumption has been that countries must always bargain to avoid conflict. This implies that they even bargain in situations when neither country would prefer war over peace under some status quo allocation of the bargaining good. Now suppose that countries only engage in Nash bargaining when either the Sovereign or the Adversary would prefer declaring war over peace under the status quo. Formally, suppose that countries bargain whenever

$$V^{i,C} + B^{i,C} > V^{i,P} + B^{i,P}_{sq} \quad \text{or equivalently} \quad R^{i,C} > B^{i,C} - B^{i,P}_{sq} \tag{27}$$

where $B^{i,P}_{sq}$ reflects an exogenous status quo allocation.

Suppose that Sovereign is the status quo power and Adversary is the rising power. Whenever Adversary's military power, as proxied by $B^{A,C}$, is sufficiently low, then there is no bargaining and

[21] Given the assumptions of quasi-linear utility and sector-specific capital as the only factor of production it follows that $\frac{r_0^{S,C}}{r_0^{S,P}} = 1$ and hence $s_0^S = 0$.

[22] The classic public goods model is appropriate for a public good like clean air. Clean air has *intrinsic value*. People like clean air because they like air to be clean. This is why it natural to begin with the assumption that public goods enter the utility function directly. National defense is different. People do not value it primarily because they are simply proud of living in a country that owns a respectable quantity of modern stealth fighter jets. Defense has *instrumental value*. It is valuable because it allows a country to obtain something else. This means that the demand for defense should be derived from a model rather than be assumed as a part of preferences. The simple gun and butter model here suggests the resulting demand for defense may look quite different from the standard public goods model.

[23] A different reason why changes in relative power can lead to war is that a status-quo power may have an incentive to attack the rising power before it becomes too strong. This scenario arises because the rising power cannot commit to not using its future power to improve its position. This problem is sometimes referred to as the Thucydides Trap.

Sovereign's welfare is given by $W^S = V^{S,P} + B_{sq}^{S,P}$. Since $B_{sq}^{S,P}$ is exogenous, there would be no national security externality. However, when $B^{A,C}$ is sufficiently high, countries bargain to avoid war, and Sovereign's welfare is given by (10). In this scenario, there would be a national security externality and an incentive to use subsidies.[24]

3. National security policy in the closed economy

This section shows that the optimal investment subsidy generalizes with minor modifications to much richer general equilibrium environments. Section 3.1 presents the generalized environment and derives the optimal investment subsidy. Section 3.2 applies the framework to study whether Sovereign should subsidize scalable technologies more.

3.1 Why the Argument Applies to More General Economies

The economy used to illustrate the argument for strategic industrial policy was based on a number of stark assumptions. There were only two goods, capital was the only factor of production, and it was assumed to be sector-specific and produced through a linear technology. However, the derivation of the expression for optimal subsidies (24) did not depend on any of these simplifications. The derivation relied on the observation that the social value of capital in an efficient Stage 3 equilibrium is proportional to its price. This is holds more generally within efficient general equilibrium models. It is closely related to the welfare theorems, and therefore the basic insight developed above will extend to more general economies.

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

[24] This extension contains an argument for why the rise of China may imply that the United States has a stronger incentive to invest in its defense industrial base, and manipulate resilience more generally, today compared to after the end of the Cold War. When China was weaker and $B^{A,C}$ was lower, there would be no reason to bargain or make concessions. If a larger economy comes with a larger $B^{A,C}$, it means China may be more willing to use military power to reshape the status quo in its favor, and the United States is more likely to face a situation where it makes concessions to a rising power to keep the peace. Resilience is then valuable because it lowers the price that is ultimately paid for peace.

Preferences We generalize consumer preferences to allow them to consume a vector $g \in \mathcal{G}$ and allow z to affect utility 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 cost caused by conflict.

Market Clearing Conditions Let $m_{hg}^{i,z}$ be the intermediate goods demand, then the market clearing condition is denoted by

$$y_g^{i,z} = c_g^{i,z} + d_g^{i,z} + \sum_{h \in \mathcal{G}} m_{hg}^{i,z}. \tag{28}$$

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

$$\sum_{g \in \mathcal{G}} k_{gf}^{i,z} = \bar{k}_f^i. \tag{29}$$

The market clearing condition for other factors of production, referred to as labor, $\ell \in \mathcal{L}$ is

$$\sum_{g \in \mathcal{G}} l_{g\ell}^{i,z} = \bar{l}_\ell. \tag{30}$$

Technologies The production technology for sector g is given by:

$$y_g^{i,z} = F_g^{i,z}(\mathbf{k}_g^{i,z}, \mathbf{l}_g^{i,z}, \mathbf{m}_g^{i,z}). \tag{31}$$

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 and is now denoted by

$$G(\bar{\mathbf{k}}^i) \leq \bar{k}^i \tag{32}$$

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

Decision problems and definitions The decision problems, income definitions, and the definition of competitive equilibrium are straightforward generalizations of the two-good case. They can be found in Appendix B.1.

Optimal Policy in the Generalized Economy The argument for policy is identical to the one before. Stage 3 welfare for a given allocation of capital is now given by

$$V^{i,z}(\bar{\mathbf{k}}^i) \equiv \max u^{i,z}(\mathbf{c}^{i,z}) \qquad \text{subject to (28)-(31).}$$

In the previous section, the conflict shock took the form of an increase in defense production. This guaranteed that total surplus decreased during war and hence (5) held. In the more general case studied here we will directly assume that total surplus is reduced during conflict. This is the case of interest for the purpose of this paper since the bargaining approach was motivated by appealing to the observation that countries facing a potential conflict have an incentive to bargain to avoid the cost of conflict. The planning problem can now be written as

$$\max_{\bar{\mathbf{k}}^S} \quad V^{S,P}(\bar{\mathbf{k}}^S) + \theta^A \left(V^{S,C}(\bar{\mathbf{k}}^S) - V^{S,P}(\bar{\mathbf{k}}^S)\right) + \mathcal{Z} \qquad \text{subject to (32).}$$

By taking first order conditions and rearranging them we obtain the following proposition

Proposition 1 (Optimal investment subsidies)**.** *The optimal investment subsidy is given by*

$$s_f^S = \theta^A \left(\frac{\bar{r}_f^{S,C}}{\bar{r}_f^{S,P}} - 1 \right). \tag{33}$$

The proof is given in Appendix C.1. Here $\bar{r}_f^{S,z} \equiv \lambda^{S,z} r_f^{S,z}$ is the price of capital used by the investment firm. It equals the stage 3 spot price of capital $r_f^{S,z}$ multiplied by the marginal utility of income of the consumer $\lambda^{S,z}$. When the marginal utility of a dollar differs between states of geopolitics the spot prices have to be corrected so that like is compared with like.[25] The reason that the richer model admits essentially the same sufficient statistic for optimal subsidies is that the price of capital goods still reflect the social marginal value of capital. This does not mean that the fundamentals of the economy do not matter; they are what ultimately determine the price changes. The proposition says that they do not matter *conditional* on these price changes.

3.2 Investment in Scalable Technologies

This section applies the generalized model to study the argument for investment subsidies to scalable technologies. The argument that it may be valuable to investment in the capacity to adjust is made by Murphy and Topel (2013), who point out two basic features of the shocks relevant to

[25] It is related to the observation that firms in general equilibrium environments use Arrow-Debreu prices to compare across states of nature. In complete market environments these Arrow-Debreu prices reflect the changes to the marginal utility of income across different states of nature.

national security economics.[26] First, the shocks of interest are often relatively rare. Second, when they do occur, they tend to be relatively large. They argue that to deal with these types of shocks, it is often more efficient to invest in the capacity to iun the capacity to scale production in response to the realization of the shock, rather than to expand capacity at all times.[27]

While Murphy and Topel show that it is valuable to invest in scalable technologies to increase resilience, they do not make the argument that markets underprovide these investments. The question we now address is whether the government should intervene in the type of technology used to produce a given good. As we will see, the answer is typically affirmative. If the price of a good appreciates during conflict, it is generally preferable to shift investment toward a more scalable production technology. This is because the marginal product of capital tends to co-move more strongly with prices when the technology is more scalable.

A Model of Scalable Technologies To study the argument for subsidizing scalable technologies, I use a variant of Murphy and Topel's model. As in Section 2, the consumer has quasi-linear utility over a numeraire good 0 and good 1 that is subject to an increase in defense production during conflict. It is the production side that is enriched compared to Section 2. There are two factors of production: capital and labor. Both are in fixed supply, but labor can be reallocated in response to z, whereas capital cannot. Good 0 serves as the numeraire good, and is produced with a linear technology given by: $c_0^{S,z} = k_0^{S,z} + l_0^{S,z}$. This simple setup pins down the equilibrium cost of capital and labor. The production of good 1 is of particular interest, as it can be produced using two different technologies, 2 and 3:

$$c_1^{S,z} = \left(k_2^{S,z}\right)^{(1-\alpha_2)v} \left(l_2^{S,z}\right)^{\alpha_2 v} + \left(k_3^{S,z}\right)^{(1-\alpha_3)v} \left(l_3^{S,z}\right)^{\alpha_3 v} \tag{34}$$

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.

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: $\frac{d \ln y_g^S}{d \ln p_1^S} = \frac{\alpha_g v}{1-\alpha_g v}$. 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. We assume

[26] 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.

[27] While Murphy and Topel emphasize climate-related shocks, their observation applies also to conflict-driven shocks. The bargaining approach to conflict provides a natural explanation for why these two features—rare and large shocks—often appear jointly in the case of conflict. The reason the probability of large conflict shocks is low is that countries bargain to avoid most of them, precisely because they are so large and costly.

that $\alpha_2 > \alpha_3$, meaning that technology 2 is more scalable ex-post. We will see this implies that $s_2^S > s_3^S$.

Solving for Optimal Subsidies To solve for the optimal subsidy, we take the first-order conditions for both technologies.[28] By combining and rearranging them, we obtain an expression for changes in capital goods prices:

$$\frac{r_g^{S,C}}{r_g^{S,P}} = \frac{p_1^{S,C}}{p_1^{S,P}} \left(\frac{l_g^{S,C}}{l_g^{S,P}} \right)^{\alpha_g v} = \frac{p_1^{S,C}}{p_1^{S,P}} \left(\frac{p_1^{S,C}}{p_1^{S,P}} \right)^{\frac{\alpha_g v}{1-\alpha_g v}} = \left(\frac{p_1^{S,C}}{p_1^{S,P}} \right)^{\frac{1}{1-\alpha_g v}}. \tag{35}$$

The optimal subsidy is then found by substituting this expression into (33). The price of capital equals its value marginal product, which consists of the price of the output multiplied by the marginal product of capital. Since the technologies produce the same good, the output price movements are identical, and the differences in changes to the marginal product drive the variation in price.

The first step in (35) 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. National Security Policy in an Open Economy

Had this paper been written during the first Cold War, a discussion of the closed economy might have sufficed. After all, the economic interdependence between Western countries and the Soviet Union was limited. Things are different today. The United States' main strategic rival, China, is highly integrated into the world economy. This means that a war would likely not only involve an expansion in defense expenditures but would also disrupt trade. Moreover, the scope for weaponizing trade to engage in economic coercion may be much greater today than in decades past, hence trade is interesting because it may be much more important to national security policy than in the past.

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

[28] 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.

of capital goods may fluctuate if the U.S. is cut off from semiconductors during a conflict with China over Taiwan. Second, trade is a source of resilience because it allows for substitution. For instance, both Russia and Ukraine rely on imports of defense equipment, easing the pressure on their domestic defense industrial base. Third, trade can be weaponized in various ways, such as by committing to sanctions (high trade taxes) during a conflict or manipulating the capital stock in another country to reduce its resilience to conflict.

4.1 Introducing Trade

We now allow for 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, we assume 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. The framework remains general enough to capture the three interactions between trade and conflict.

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

$$y_g^{i,z} + x_g^{i,z} = c_g^{i,z} + d_g^{i,z} + \sum_{h \in \mathcal{G}} m_{hg}^{i,z} \quad \text{where} \quad x_g^{S,z} = \sum_{j \in \mathcal{J}} x_g^{Sj,z} \tag{36}$$

where, $x_g^{i,z}$ refers to net imports of country i. We only keep track of the identity of the trading partner for Sovereign. Sovereign's net imports from j are denoted by $x_g^{Sj,z}$. Since countries only trade with Sovereign, the international market clearing condition for each $j \in \mathcal{J}$ is given:

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

The trade balance conditions for the trading partners and Sovereign are respectively given by:

$$\sum_{g \in \mathcal{G}} q_g^{j,z} x_g^{j,z} = 0 \quad \text{and} \quad \sum_{g \in \mathcal{G}} q_g^{j,z} x_g^{Sj,z} = 0. \tag{38}$$

Here, $q_g^{j,z}$ denotes the international price between Sovereign and country j. They equal domestic prices for trading partners j but can differ from domestic prices for Sovereign due to taxes $t_g^{Sj,z}$:

$$p_g^{S,z} = (1 + t_g^{Sj,z}) q_g^{j,z} \quad \text{and} \quad p_g^{j,z} = q_g^{j,z}. \tag{39}$$

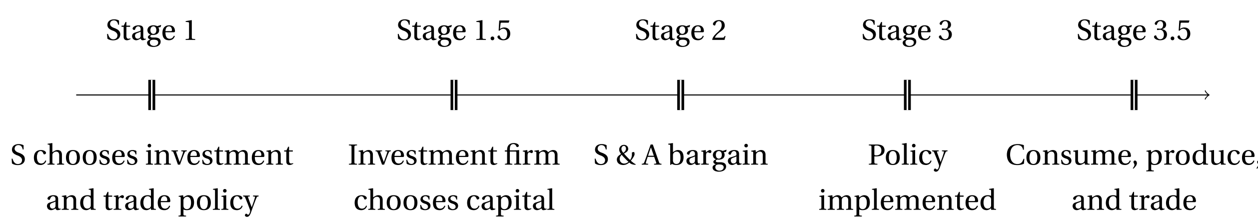
The decision problems of agents and the definition of and the lump-sum tax can be found in Appendix B.2. The definition of competitive equilibrium now becomes

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.[29] 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.3.

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



4.2 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

[29] 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.

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

$$V^{i,z}(\bar{\mathbf{k}}^i, \mathbf{x}^{i,z}) \equiv \max u^{i,z}(\mathbf{c}^{i,z}) \qquad \text{subject to (29)–(31) and (36).} \tag{41}$$

As before, the competitive equilibrium, conditional on the allocation of capital and trade, is efficient. Hence, 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 in the open economy is similar to the closed economy except that Sovereign can now also choose trade patterns and must satisfy the appropriate trade balance conditions. The planning problem is now given by

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

The derivation of this planning problem is found in Appendix C.2. The ability to manipulate trade introduces a new motive for policy relative to the closed economy. In the closed economy, there was only the defensive motive—to manipulate domestic resilience—since there were no policy instruments to manipulate Adversary's resilience to conflict. The open economy introduces an offensive motive for policy—to intervene in trade to reduce Adversary's resilience to conflict.

4.3 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:

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

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:

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

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.

5. Domestic Resilience in the Open Economy

This section studies the use of investment subsidies and trade taxes to enhance domestic resilience. Section 5.1 provides a general characterization of optimal investment subsidies and trade policy. Section 5.2 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. Section 5.3 discusses three applications of the investment subsidy expression to national security policy.

5.1 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 $\theta^A > 0$. This makes the offensive motive for trade policy disappear because bargaining outcomes no longer depend on Adversary's resilience to conflict. The planning problem of interest is given by:

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

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

Proposition 3 (Policy and Domestic Resilience). *Sovereign uses investment subsidies, given by*

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

Trade taxes during conflict are

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

Trade taxes during peace are given by

$$t_g^{Sj,P} = \mathcal{E}_g^{Sj,PP} + \psi^{Sj} \mathcal{E}_g^{Sj,CP}. \tag{47}$$

The derivation of the optimal investment subsidy is identical to the closed economy case. The reason (45) is unchanged compared to the closed economy case is that trade did not introduce additional distortions that are best targeted by investment subsidies. There is an incentive to distort trade patterns but trade policy can target this directly and is therefore the preferred instrument by the planner.

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. Here ψ^{Sj} captures the willingness to trade off terms-of-trade gains during conflict for those during peace and is defined along with the proof of the proposition in Appendix C.5.

5.2 Domestic Resilience and Trade Policy

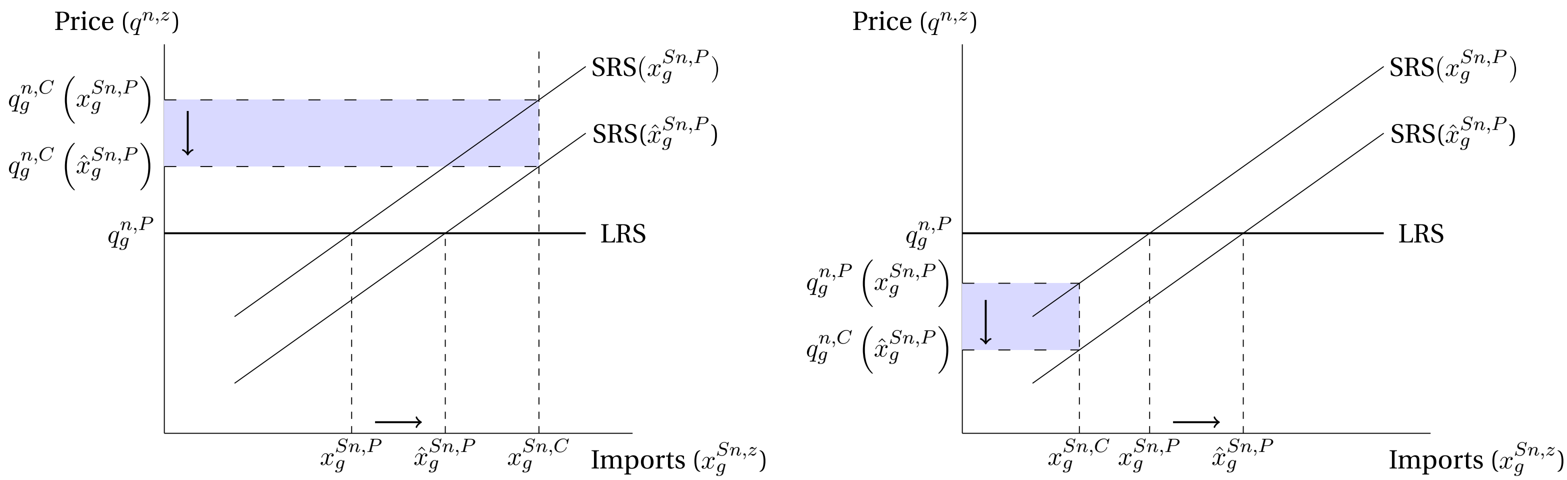
Two concrete insights from the above expressions for trade policy are developed here. First, trade policy can be used to manipulate the capital stock in third, friendly countries, thereby influencing the terms of trade. Reallocating productive capacity to third, friendly countries has frequently been discussed under the label of "friendshoring." Second, despite concerns about resilience to conflict, there is no overall reason to intervene in trade in the absence of terms-of-trade manipulation. The argument that trade should be restricted to protect domestic capacity for strategic reasons is not supported. Instead, support for domestic capacity should take the form of investment subsidies.

5.2.1 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. One interpretation of the cross-state-of-politics terms-of-trade (ToT) term, in equation (47), is that it attempts to do exactly that.

For concreteness, consider the following example. 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.

Figure 4: The argument for preemptively increasing imports



(a) Gains when imports rise during conflict

(b) Gains when imports fall during conflict

Figure 4 builds on the idea 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.

Discussion The above examples provide an argument for why countries might want to use trade policy to friendshore productive capacity. The sectors that may be prioritized for friendshoring will generally depend on the shock driving changes in import expenditure between peace and conflict. In the case of a defense shock, Europeans may want to buy more ammunition from the Americans to expand the latter's defense industrial base. If the conflict involves a trade disruption with Taiwan, it seems reasonable to assume that expenditure on semiconductor imports from other friendly countries will rise. In this case, there is an argument to friendshore semiconductor manufacturing capacity.

When should a country friendshore, and when should production be brought home? The answer is somewhat subtle and is developed in Kooi (2024). To understand the idea, first note that trade policy is a second-best way to reallocate capital in third countries. A more direct way would be to pay neutral countries to reallocate their capital stock. In Kooi (2024) this arrangement is labeled an economic security union. I show that the sectors Sovereign would like neutrals to invest in are those in which they have a comparative advantage over Sovereign, but do not specialize in equilibrium because they have a greater comparative advantage in another sector. The logic is simple: if Sovereign has a comparative advantage over neutrals, it is efficient to produce the good domestically. If neutrals have a large comparative advantage, they would already be naturally specializing in that sector in equilibrium, so there is no need to incentivize them further. It is the goods in between that should be friendshored.

5.2.2 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."[30]

This type of argument is still often heard today. The core of the argument is that imports crowd

[30] 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.

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:*

$$t_g^{Sj,z} = 0. \tag{48}$$

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 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.

5.3 Investment Policy in the Open Economy

The role of investment policy remains the same across the open and closed economy; to enhance Sovereign's resilience to conflict by manipulating its capital stock. This section uses equation (45) to study the role of investment policy to reduce national security externalities in the open economy. Section 5.3.1 shows that optimal investment subsidies can be used to reshore production, i.e., investment subsidies lean against the pattern of trade. Section 5.3.2 examines specific features of an industry that make reshoring particularly advantageous and uses it to briefly discuss the semiconductor sector. Section 5.3.3 shows that Sovereign may benefit from investing in its ability to change the source of imports in response to conflict.

5.3.1 Reshoring Productive Capacity

This section shows that the investment subsidies in Proposition 3 may take the form of reshoring—specifically, increasing domestic capacity in sectors with high net imports. Reshoring is one of the most frequently discussed supply-side interventions in support of national security; another would be the effort to rebuild the defense industrial base, which was discussed in Sections 2 and 3. One may have thought that investment subsidies to the defense industrial base and reshoring are policy solutions to different externalities. The implication of the framework developed here is that they can be thought of as solutions to the same national security externality; their difference instead lies in the shocks they build resilience to—military versus trade shocks.

To make the point that investment subsidies can encourage reshoring, a simple example suffices. Consider again the case where Sovereign is a small open economy that only trades with Adversary, implying it takes $q_g^{SA,z}$ as given. Household utility is again quasi-linear, and good 0 is the numeraire. Each good is produced using a single sector-specific capital good $y_g^{i,z} = f_g^i(k_g^{i,z})$, which is in fixed supply. 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:

$$s_g^S = \theta^A \left(\frac{q_g^{SA,C}}{q_g^{SA,P}} - 1 \right). \tag{49}$$

Whether policy leans against the pattern of trade depends on how $q_g^{SA,z}$ relates to the pattern of trade. Consider the case where prices for imported goods tend to rise while prices of exported goods tend to fall with conflict. By tend to rise and fall I mean if one looks in the cross-section of sectors one would see a positive covariance between price growth caused by conflict and the quantity of imports. In this case it follows from equation (49) that

$$\text{if} \quad \text{cov}\left(x_g^{SA,P}, \frac{q_g^{SA,C}}{q_g^{SA,P}} - 1 \right) > 0 \quad \text{then} \quad \text{cov}(x_g^{SA,P}, s_g^S) > 0. \tag{50}$$

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.

5.3.2 The Argument for Subsidizing Semiconductors

This section develops an example to discuss the targetting of investment subsidies that reshoring capacity in more detail. It uses the semiconductor sector as a working example since the U.S. government has used investment subsidies to reshore capacity in this sector. A common argument for subsidizing semiconductors proceeds as follows: First, semiconductors are a "critical" good, making it costly to reduce their use. Second, many of the most advanced semiconductors are produced in Taiwan, so imports are likely to be disrupted during a conflict between the U.S. and China, as that conflict would likely involve Taiwan. Lastly, because semiconductors are a highly advanced commodity, it is difficult to ramp up production domestically in the short run. This makes it unlikely that domestic output can quickly increase, and substitution to other countries is difficult, as they face the same problem.

While the theory sometimes points to flaws in standard policy argument, such as in Section 5.2.2, the above argument can be consistent with the framework develop here. The key observation that, while the above argument may seem like distinct but complementary arguments there is a sense in which they are all similar; they are all effectively determinants of the shape of the domestic derived demand curve for installed capital in the semiconductor sector.

The Derived Demand for Capital To see how the above arguments can be interpreted as determinants of the derived demand curve for capital we turn to a formal example. Consider an economy where final goods are produced by combining domestic goods with a bundle of foreign varieties. There is a single factor of production: capital. The supply of capital is perfectly elastic in the long run but inelastic in the short run, meaning it cannot respond to the realization of z. The output of a domestic variety is linear in the capital employed in that sector, $y_g^{S,z} = k_g^{S,z}$.

Sovereign has quasi-linear preferences over a numeraire good and final goods. The numeraire good can only be produced using domestic varieties and is exported to finance the imports of foreign varieties. The final good is produced through a Cobb-Douglas aggregator of the domestic variety and an aggregate foreign good. The foreign good, in turn, is a CES aggregator of all goods produced by Sovereign's trading partners. The utility function and aggregators are given respectively 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 $\alpha_{Sg} + \alpha_{\mathcal{J}g} = 1$.

We now solve for the changes in prices of capital goods, $\bar{r}_g^{S,z}$, in response to changes in the prices of imported goods, $q_{jg}^{S,z}$. Since utility is additively separable, this can be done sector by sector. We focus on 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 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:

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

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

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

The expression relates the derived demand curve to output demand elasticities, trade elasticities, and import shares. The first determinant of the shift of the derived demand curve is the elasticity of demand for the final good, σ_g. If we understand a "critical good" to imply a low elasticity of demand, then the demand for domestic capital shifts outward.[31] The second determinant of the

[31]The reason the threshold of $\sigma_g < 1$ is unity reflects the traditional scale versus substitution effect in the analysis of derived factor demand. The increase in import costs drives up the cost of the final goods bundle, leading to a fall in demand captured by σ_g—this is the scale effect. Meanwhile, the change in the composition of the bundle toward domestic goods due to higher import costs represents the substitution effect. This threshold is unity due to the Cobb-Douglas assumption.

shift of the derived demand curve is the trade elasticity. The easier it is to substitute, the less the relevant measure of import costs rises. If it is low for semiconductors, it strengthens the argument for subsidizing the sector. The last determinants are the expenditure share on foreign goods, $\alpha_{\mathcal{J}g}$, and import shares, χ^S_{jg}. Since the U.S. imports a substantial amount of semiconductors from Taiwan, which is exposed to potential conflict with China, this also favors semiconductors. The low elasticity of demand, σ_g, also means that the elasticity of derived factor demand is low, again favoring high subsidies.

5.3.3 Investment in the Capacity to Substitute

This section provides another 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. Suppose that 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 terminal over pipelines *but only if the option to switch is exercised during conflict.*

A Formal Example 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. The utility function and import technologies are 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.[32]

The key difference between the two technologies is that gas can only be imported from Adversary via pipelines ,$x^{S,z}_{pipe} = x^{SA,z}_{pipe}$, while terminals can import from both Adversary and a neutral third country , $x^{S,z}_{term} = x^{SA,z}_{term} + x^{Sn,z}_{term}$. Each technology will always 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:

$$\hat{r}^S_g = \hat{p}^S_{gas}\left(\hat{x}^S_g\right)^{(1-\alpha)v} = \hat{p}^S_{gas}\left(\frac{\hat{p}^S_{gas}}{\hat{q}^S_g}\right)^{\frac{(1-\alpha)v}{1-(1-\alpha)v}}, \tag{51}$$

[32] 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.

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 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.

6. Weaponizing Trade and Economic Coercion

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 $\theta^S > 0$)**.** *Optimal investment policy is given by*

$$s^S_f = \theta^A \left(\frac{\bar{r}^{S,C}_f}{\bar{r}^{S,P}_f} - 1 \right).$$

Trade taxes against Adversary during conflict are given by

$$t^{SA,C}_g = (1 + \gamma^{S,C}) \mathcal{E}^{SA,CC}_g. \tag{52}$$

Trade taxes during peace against Adversary are given by

$$t^{SA,P}_g = (1 - \gamma^{S,P}) \mathcal{E}^{SA,PP}_g + \left(\psi^{SA}_{def} + \psi^{SA}_{off} \right) \mathcal{E}^{SA,PC}_g + \gamma^{S,P} \sum_{f \in \mathcal{F}} \left[\frac{\bar{r}^{A,C}_g}{\bar{r}^{S,C}_g} - 1 \right] \rho^{SA}_{fg} \frac{\bar{r}^{A,P}_f \bar{k}^A_f}{q^{SA,P}_g x^{SA,P}_g}. \tag{53}$$

Here, $\gamma^{S,C}$ captures the value of lowering Adversary's welfare during conflict, and $\gamma^{S,P}$ captures the value of raising Adversary's welfare during peace. These values are positive when the multiplier on the trade balance condition is positive. Next, ψ has the same interpretation as before, but the proposition decomposes it into two terms, ψ^{SA}_{def} and ψ^{SA}_{off}, to facilitate interpretation later. Lastly, $\rho^{SA}_{fg} = \frac{\partial \bar{k}^A_f}{\partial x^{SA,P}_g} \frac{x^{SA,P}_g}{\bar{k}^A_f}$ is the elasticity of capital good f with respect to trade in good g during peace.

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 (52) when $\gamma^{S,C} = 0$. 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.[33]

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.[34]

Terms of Trade Manipulation During Peace The first term in equation (53) shows that bargaining introduces a rationale to lower trade taxes during peace. Like sanctions, the rationale is to reduce Adversary's resilience to conflict, but it does so by raising Adversary's welfare during peace. Suppose we ignore capital for a moment; in this case, the last two terms would disappear. Then, optimal taxes would equal those that maximize terms of trade whenever $\gamma^{S,P} = 0$. The perturbation argument, similar to that used for sanctions, would then explain why Sovereign would want to choose lower trade taxes during peace.

An Interpretation of Foe-Shoring The second term in equation (53) reflects the incentive to use trade during peace to manipulate terms of trade during conflict by affecting the capital stock. This was previously discussed as friendshoring, but the motive to hurt Adversary introduces an additional rationale for this type of policy. This motive is best understood through 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. These considerations are both captured by the multiplier on the trade balance conditions, absorbed in the ψ^{SA} term. The appendix provides a simple decomposition, such that $\psi^{SA} = \psi^{SA}_{def} +$

[33]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 adversaries. 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 $\gamma^{S,C}$, 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.

[34]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.

ψ^{SA}_{off}. Here, $\psi^{SA}_{def} = 0$ when Sovereign does not value domestic resilience ($\theta^A = 0$), and $\psi^{SA}_{off} = 0$ when $\theta^S = 0$ and Sovereign does not value Adversary's resilience.

Reverse Industrial Policy The third term in equation (53) 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 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.[35] 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.

7. 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.

7.1 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.

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

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.

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?[36] This implies that $\bar{r}_g^{S,P} d\bar{k}_g^S = 1$. The resulting change in welfare is given by:

$$dW^S = \frac{\partial V^{S,P}}{\partial \bar{k}_g^S} d\bar{k}_g^S + \theta^A \left(\frac{\partial V^{S,C}}{\partial \bar{k}_g^S} - \frac{\partial V^{S,P}}{\partial \bar{k}_g^S} \right) d\bar{k}_g^S \tag{54}$$

[36]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.

$$= \underbrace{1}_{\text{Neoclassical value}} + \underbrace{\theta^A \left(\frac{\bar{r}_g^{S,C}}{\bar{r}_g^{S,P}} - 1 \right)}_{\text{Strategic value}} \tag{55}$$

Section 7.4 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.

7.2 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.

7.3 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 5.3.2 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:

$$u^{S,z} = \sum_{g \in \mathcal{G}} \beta_g^S \ln C_g^{S,z}. \tag{56}$$

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:

$$X_g^{S,z} = \left(\sum_{j \in \mathcal{J}} a_{Xjg}^{\frac{1}{\eta_g}} \left(x_{jg}^{S,z}\right)^{\frac{\eta_g-1}{\eta_g}} \right)^{\frac{\eta_g}{\eta_g-1}} \tag{57}$$

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 $\bar{\mathbf{k}}_g^S$ 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

$$p_{jg}^{S,z} = (1 + \tau_{jg}^{Sj,z}) b_{jg} \left(x_{jg}^{Sj,z} \right)^{\omega}. \tag{58}$$

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:

$$x_{Sg}^{j,z} = a_{Sg}^{j} \left((1 + \tau_{Sg}^{j,z}) p_{Sg}^{S,z} \right)^{-\sigma} \tag{59}$$

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 (55) 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

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)

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

7.4 Results

7.4.1 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.[37]

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

The second observation is that the strategic values for the Taiwan scenario are relatively small. As seen from (55), 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 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.

7.4.2 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 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

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.

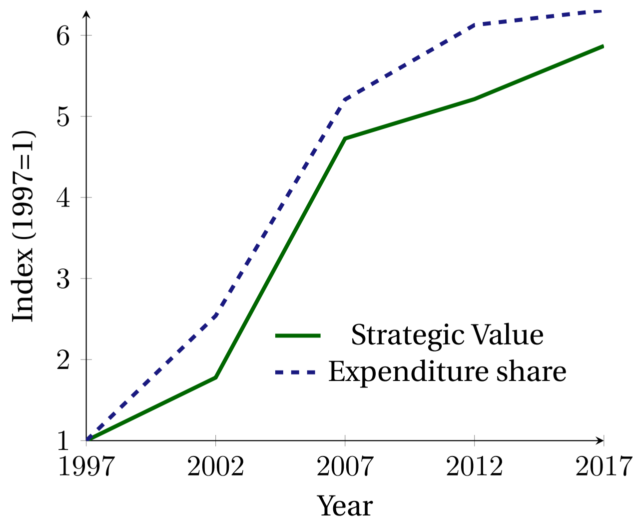
between 1997 and 2017.

8. Conclusion

The return of great power conflict led to a resurgence of national security considerations in the economic policy agenda. This paper has presented a framework where bargaining in the shadow of conflict led to an underprovision of domestic resilience to conflict in the laissez-faire competitive equilibrium. It then showed that a number of policy issues can be studied as ways to alleviate the national security externality by directly intervening in the decisions that generate resilience to conflict. The paper showed that investment subsidies to the defence 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 of the analysis is that the bargaining approach to conflict may

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

serve as a useful starting point for economists interested in applying economic analysis to national security policy prescriptions. One can begin with an approach to conflict that is well-established in the literature on war and has been applied previously to the study of national security by Thomas Schelling. 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.

References

Acemoglu, Daron and Alireza Tahbaz-Salehi, "The macroeconomics of supply chain disruptions," *Review of*

Economic Studies, 2024, p. rdae038.

—, Mikhail Golosov, Aleh Tsyvinski, and Pierre Yared, "A dynamic theory of resource wars," *The Quarterly Journal of Economics*, 2012, *127* (1), 283–331.

Alekseev, Maxim and Xinyue Lin, "Trade Policy in the Shadow of Conflict: The Case of Dual-Use Goods," 2024. Unpublished manuscript.

Atalay, Enghin, "How important are sectoral shocks?," *American Economic Journal: Macroeconomics*, 2017, *9* (4), 254–280.

Baldwin, David A, *Economic statecraft*, Princeton University Press, 1985.

Baliga, Sandeep and Tomas Sjöström, "Bargaining and war: A review of some formal models," *Korean Economic Review*, 2013, *29* (2), 235–266.

Bartelme, Dominick G, Arnaud Costinot, Dave Donaldson, and Andres Rodriguez-Clare, "The textbook case for industrial policy: Theory meets data," Technical Report, National Bureau of Economic Research 2019.

Becko, John Sturm and Daniel G O'Connor, "Strategic (Dis) Integration," *Working paper*, 2024.

Bergmann, Max, Maria Snegovaya, Tina Dolbaia, Nick Fention, and Samuel Bendett, *Out of Stock?: Assessing the Impact of Sanctions on Russia's Defense Industry*, Center for Strategic & International Studies, 2023.

Bianchi, Javier and César Sosa-Padilla, "International sanctions and dollar dominance," Technical Report, National Bureau of Economic Research 2023.

Blackwill, Robert D and Jennifer M Harris, *War by other means: Geoeconomics and statecraft*, Harvard University Press, 2016.

Broda, Christian and David E Weinstein, "Globalization and the Gains from Variety," *The Quarterly journal of economics*, 2006, *121* (2), 541–585.

Clayton, Christopher, Matteo Maggiori, and Jesse Schreger, "A Framework for Geoeconomics," Technical Report, National Bureau of Economic Research 2023.

—, —, and —, "A Theory of Economic Coercion and Fragmentation," *Working paper*, 2024.

Dekle, Robert, Jonathan Eaton, and Samuel Kortum, "Global rebalancing with gravity: Measuring the burden of adjustment," *IMF staff papers*, 2008, *55* (3), 511–540.

Dixit, Avinash, "Thomas Schelling's contributions to game theory," *The Scandinavian Journal of Economics*, 2006, *108* (2), 213–229.

Fajgelbaum, Pablo D, Pinelopi K Goldberg, Patrick J Kennedy, and Amit K Khandelwal, "The return to protectionism," *The Quarterly Journal of Economics*, 2020, *135* (1), 1–55.

Farrell, Henry and Abraham L Newman, “Weaponized interdependence: How global economic networks shape state coercion,” *International Security*, 2019, *44* (1), 42–79.

Fearon, James D, “Rationalist explanations for war,” *International organization*, 1995, *49* (3), 379–414.

Grossman, Gene M, Elhanan Helpman, and Alejandro Sabal, “Resilience in Vertical Supply Chains,” Technical Report, National Bureau of Economic Research 2023.

— , — , and Hugo Lhuillier, “Supply Chain Resilience: Should Policy Promote International Diversification or Reshoring?,” *Journal of Political Economy*, 2023, pp. 3462–3496.

Harrison, Ann and Andrés Rodríguez-Clare, “Trade, foreign investment, and industrial policy for developing countries,” *Handbook of development economics*, 2010, *5*, 4039–4214.

Hirschman, Albert O, *National power and the structure of foreign trade*, Vol. 105, Univ of California Press, 1945.

Hirshleifer, Jack, “The technology of conflict as an economic activity,” *The American Economic Review*, 1991, *81* (2), 130–134.

Itskhoki, Oleg and Benjamin Moll, “Optimal development policies with financial frictions,” *Econometrica*, 2019, *87* (1), 139–173.

Jones, Lin, Sarah Krulikowski, Nathan Lotze, and Samantha Schreiber, *US Exposure to the Taiwanese Semiconductor Industry*, US International Trade Commission, 2023.

Juhász, Réka, Nathan J Lane, and Dani Rodrik, “The New Economics of Industrial Policy,” Technical Report, National Bureau of Economic Research 2023.

Kooi, Olivier, “A theory of the economic security union,” Technical Report 2024.

Lane, Nathaniel, “The new empirics of industrial policy,” *Journal of Industry, Competition and Trade*, 2020, *20*, 209–234.

Lashkaripour, Ahmad and Volodymyr Lugovskyy, “Profits, scale economies, and the gains from trade and industrial policy,” 2022.

Lazear, Edward P, “Economic imperialism,” *the Quarterly Journal of economics*, 2000, *115* (1), 99–146.

Liu, Ernest, “Industrial policies in production networks,” *The Quarterly Journal of Economics*, 2019, *134* (4), 1883–1948.

— and David Yang, “International Power.,” 2024.

Martin, Philippe, Thierry Mayer, and Mathias Thoenig, “Make trade not war?,” *The Review of Economic Studies*, 2008, *75* (3), 865–900.

McLaren, John, “Size, sunk costs, and Judge Bowker’s objection to free trade,” *The American Economic Review*, 1997, pp. 400–420.

Morgan, T Clifton, Constantinos Syropoulos, and Yoto V Yotov, “Economic sanctions: Evolution, consequences, and challenges,” *Journal of Economic Perspectives*, 2023, *37* (1), 3–29.

Murphy, Kevin M and Robert H Topel, “Some basic economics of national security,” *American Economic Review*, 2013, *103* (3), 508–511.

Osgood, Theodore Kent, *East-West trade controls and economic warfare*, Yale University, 1957.

Pierce, J and P Schott, “Vconcording us harmonized system codes over time,” *Journal of Offi cial Statistics*, 2009.

Powell, Robert, “Absolute and relative gains in international relations theory,” *American Political Science Review*, 1991, *85* (4), 1303–1320.

Ricardo, David, *On the principles of political economy*, J. Murray London, 1821.

Samuelson, Paul A, “The pure theory of public expenditure,” *The review of economics and statistics*, 1954, pp. 387–389.

Schelling, T.C., *International Economics*, Allyn and Bacon, 1958.

Schelling, Thomas C., *The Strategy of Conflict*, Cambridge and London: Harvard University Press, 1960.

— , *Arms and Influence*, New Haven and London: Yale University Press, 1966.

Skaperdas, Stergios, “Cooperation, conflict, and power in the absence of property rights,” *The American Economic Review*, 1992, pp. 720–739.

Smith, Adam, *An Inquiry into the Nature and Causes of the Wealth of Nations*, Vol. 1, W. Strahan and T. Cadell, London, 1776.

Souza, Gustavo De, Naiyuan Hu, Haishi Li, and Yuan Mei, “(Trade) war and peace: How to impose international trade sanctions,” *Journal of Monetary Economics*, 2024, p. 103572.

Sturm, John, “A theory of economic sanctions as terms-of-trade manipulation,” *Working paper*, 2022.

Taylor, Telford, *Munich: The Price of Peace*, New York: Doubleday, 1979.

Thoenig, Mathias, *Trade Policy in the Shadow of War: A Quantitative Toolkit for Geoeconomics*, Centre for Economic Policy Research, 2023.

Thompson, Earl A, “An economic basis for the” national defense argument” for aiding certain industries,” *Journal of Political Economy*, 1979, *87* (1), 1–36.

Wu, Y., *Economic Warfare* Prentice-Hall economics series, Prentice-Hall, 1952.

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. In the absence of asymmetric information, things are essentially isomorphic to the generalized Nash bargaining solution. Bargaining works as follows: a player i' is selected to make a take-it-or-leave-it offer to the other player with probability $\theta^{i'}$. The other player then draws an additive preferences shock that shifts their cost of conflict. It is denoted by $\zeta^{i,P}$ 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.

We will supress the capital as an argument to ease notation. Player i rejects an offer by i' when:

$$\zeta^{i,C} < B_{i'}^{i,P} - B^{i,C} - R^i \tag{A.1}$$

where $B_{i'}^{i,P}$ denote the bargaining goods i' proposes that i would receive if they accept the offer and R^i is defined according to (6). The probability of conflict is then given by :

$$\mathcal{P}_{i'}^C(B_{i'}^{i,P}, R^i) \equiv F(B_{i'}^{i,P} - B^{i,C} - R^i). \tag{A.2}$$

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

$$B_A^{S,P} \in \text{argmax}\, \mathcal{P}_A^P(B_A^{S,P}, R^S)\left(V^{A,P} + \bar{B} - B_A^{S,P}\right) + \left(1 - \mathcal{P}_A^P(B_A^{S,P}, R^S)\right)\left(V^{A,C} + B^{A,C}\right). \tag{A.3}$$

We denote the solution of this problem as a function of R^S as $B_A^{S,P}(R^S)$.

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

$$\begin{aligned}
\max_{\bar{\mathbf{k}}^S, B_S^{A,P}} \theta^S &\left(\mathcal{P}_S^P(B_S^{A,P}, R^A)\left(V^{S,P} + \bar{B} - B_S^{A,P}\right) + \mathcal{P}_S^C(B_S^{A,P}, R^A)\left(V^{S,C} + B^{S,C}\right)\right) \\
&+ \theta^A\left[\int_{\underline{\zeta}}^{\bar{\zeta}} \max\left[V^{S,P} + B_A^{S,P}\left(R^S\right), V^{S,C} + B^{S,C} + \zeta^{S,C}\right] f(\zeta^{S,C}) d\zeta^{S,C}\right] \\
&\text{subject to (11).}
\end{aligned}$$

Note that Sovereign takes R^A as given since it takes capital as given.

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

$$\mathcal{P}^P \frac{\partial V^{S,P}}{\partial \bar{k}_g^S} + \mathcal{P}^C \frac{\partial V^{S,C}}{\partial \bar{k}_g^S} + \theta^A \mathcal{P}_A^P \frac{\partial B_A^{S,P}}{\partial R^S} \left(\frac{\partial V^{S,C}}{\partial \bar{k}_g^S} - \frac{\partial V^{S,P}}{\partial \bar{k}_g^S} \right) = \hat{\mu}^S \tag{A.4}$$

here I used $\mathcal{P}^z = \theta^S \mathcal{P}_S^z + \theta^A \mathcal{P}_A^z$ to simplify the expresion.

Competitive equilibrium I begin by introducing complete markets that allow domestic agents to trade Arrow-Debreu securities that condition on z between eachother. This allow me to derive state contingent prices which I denote M^z. The consumer budget constraint is denoted as

$$\sum_{z \in \{P,C\}} M^{i,z} \sum_{g \in \{0,1\}} p_g^{i,z} c_g^{i,z} = \sum_{z \in \{P,C\}} M^{i,z} (T^{i,z} + \Pi^{i,z}) \tag{A.5}$$

Since both states of geopolitics are now reached with positive probability we can allow the consumer to choose a consumption plan during stage 1.

$$(c_0^{i,P}, c_1^{i,P}, c_0^{i,C}, c_1^{i,C}) \in \text{argmax} \left\{ \sum_{z \in \{P,C\}} \mathcal{P}^z u^i(c_0^{i,z}, c_1^{i,z}) \right\} \quad \text{subject to} \quad (\text{A.5}). \tag{A.6}$$

The firms problem is to maximize

$$(\bar{k}_0^i, \bar{k}_1^i) \in \text{argmax} \left\{ \sum_{z \in \{P,C\}} M^{i,z} \sum_{g \in \{0,1\}} r^{i,z} \bar{k}_g^i (1 + s_g^{i,z}) | \sum_{g \in \{0,1\}} \bar{k}_g^i = \bar{k}^i \right\}. \tag{A.7}$$

The first order condition for the firm is therefore given by

$$M^{i,P} r_g^{i,P} (1 + s_g^{i,P}) + M^{i,C} r_g^{i,C} = \mu^i \tag{A.8}$$

Solving for the optimal subsidy The first order condition of the household stage 1 problem is given by $\mathcal{P}^z \frac{\partial u^{S,z}}{\partial c_g^{S,z}} = \lambda^S M^{S,z} p_g^{S,z}$. The first order condition of the household during the stage 3 problem is given by $\frac{\partial u^{S,z}}{\partial c_g^{S,z}} = \lambda^{S,z} p_g^{S,z}$. It follows that $\lambda^S M^{S,z} = \mathcal{P}^z \lambda^{S,z}$. The first order condition of the investment firm can now be written as

$$\lambda^{S,P} r_g^{S,P} (1 + s_g^{i,P}) + \lambda^{S,C} r_g^{S,P} = \frac{\mu^S}{\lambda^S} \tag{A.9}$$

Combining the envelope condition of the stage 3 planning problem with the first order conditions again yields

$$\frac{\partial V^{S,z}}{\partial \bar{k}^S_g} = \frac{\partial u^{S,z}}{\partial c^{S,z}_g}\frac{\partial f^{S,z}_g}{\partial \bar{k}^S_g} \tag{A.10}$$

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

$$\frac{\partial u^{S}}{\partial c^{S,z}_g}\frac{\partial f^{S}_g}{\partial k^{S,z}_g} = \lambda^{S,z} r^{S,z}_g \tag{A.11}$$

The first order condition of the investment firm

$$\mathcal{P}^P\lambda^{S,P}r^{S,P}_g + \mathcal{P}^C\lambda^{S,C}r^{S,C}_g + \theta^A\mathcal{P}^P_A\frac{\partial B^{S,P}_A}{\partial R^S}\left(\lambda^{S,P}r^{S,P}_g - \lambda^{S,C}r^{S,C}_g\right) = \frac{\hat{\mu}^S}{\lambda^S}. \tag{A.12}$$

Suppose I focus on rescaling subsidies such that $\mu^S = \hat{\mu}^S$ the I obtain

$$(1+s^{S,P}_g) = \theta^A\mathcal{P}^P_A\frac{\partial B^{S,P}_A}{\partial R^S}\frac{\lambda^{S,P}r^{S,P}_g - \lambda^{S,C}r^{S,C}_g}{\lambda^{S,P}r^{S,P}_g} = \theta^A\mathcal{P}^P_A\frac{\partial B^{S,P}_A}{\partial R^S}\left(\frac{\bar{r}^{S,C}_g}{\bar{r}^{S,P}_g} - 1\right) \tag{A.13}$$

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:

$$\left(\mathbf{c}^{i,z}\right) \in \text{argmax}\left\{B^{i,z} + u^i(\mathbf{c}^{i,z}) | \sum_{g\in\mathcal{G}} p^{i,z}_g c^{i,z}_g = \Pi^{i,z} + T^{i,z} + \sum_{\ell\in\mathcal{L}} w^{i,z}_\ell \bar{l}^i_\ell\right\} \tag{B.1}$$

$$\left(\mathbf{k}^{i,z}_g, \mathbf{l}^{i,z}_g, \mathbf{m}^{i,z}_g\right) \in \text{argmax}\left\{p^{i,z}_g F^{i,z}_g(\mathbf{k}^{i,z}_g, \mathbf{l}^{i,z}_g, \mathbf{m}^{i,z}_g) - \sum_{f\in\mathcal{F}} r^{i,z}_f k^{i,z}_{gf} - \sum_{\ell\in\mathcal{L}} w^{i,z}_\ell l^{i,z}_{g\ell} - \sum_{h\in\mathcal{G}} p^{i,z}_g m^{i,z}_{gh}\right\} \tag{B.2}$$

$$\left(\bar{\mathbf{k}}^i\right) \in \text{argmax}\left\{\sum_{f\in\mathcal{F}} r^{i,P}_f(1+s^i_f)\bar{k}^i_f | G(\bar{\mathbf{k}}^i_f) \le \bar{k}^i\right\} \tag{B.3}$$

$$\Pi^{i,z} = \sum_{g\in\mathcal{G}}\left(p^{i,z}_g y^{i,z}_g - \sum_{f\in\mathcal{F}} r^{i,z}_f k^{i,z}_{gf} - \sum_{\ell\in\mathcal{L}} w^{i,z}_\ell l^{i,z}_{g\ell}\right) + \sum_{f\in\mathcal{F}} r^{i,P}_f(1+s^i_f)\bar{k}^i_f \tag{B.4}$$

$$T^{i,z} = \sum_{f\in\mathcal{F}} r^{i,P}_f s^i_f \bar{k}^i_f + \sum_{g\in\mathcal{G}} p^{i,z}_g d^{i,z}_g. \tag{B.5}$$

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

Definition 4 (Competitive equilibrium with subsidies)**.** *Given policies subsidies* $\mathbf{s}^i$ *and outcomes of the bargaining game* z *and* $B_{i'}^{i,z}$*, a 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* $\{\mathbf{c}^{i,z}, \mathbf{y}^{i,z}, \mathbf{m}^{i,z}\}$*, and a lump sum transfer* $T^{i,z}$ *that satisfies* (28)-(32) *and* (B.1)-(B.5)

B.2 Additional details for Section 3

The decision problems of the different agents and the definition of profits are still given by (B.1)-(B.4). The lump sum tax is now given by

$$T^{S,z} = \sum_{f\in\mathcal{F}} r_f^{S,P} s_f^S \bar{k}_f^S + \sum_{g\in\mathcal{G}} p_g^{S,z} d_g^{S,z} - \sum_{g\in\mathcal{G}} \sum_{j\in\mathcal{J}} p_g^{S,z} x_g^{S,z} t_g^{S,z}. \tag{B.6}$$

B.3 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

$$(\tilde{B}^{S,P}, \tilde{B}^{A,P}) \in \operatorname{argmax} \left(\tilde{B}^{S,P} - R^S - B^{S,C}\right)^{\delta^S} \left(\tilde{B}^{A,P} - R^A - B^{A,C}\right)^{\delta^A}$$
$$\text{subject to} \quad (4)$$

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:

$$B^{S,P} = \pi\tilde{B}^{S,P} + (1-\pi)\dot{B}^{S,P} = \pi\delta^A R^S + \pi\delta^S R^A + \pi B^{S,C} + (1-\pi)B^{S,C} \tag{B.7}$$
$$= \theta^A R^S + \theta^S R^A + B^{S,C} \tag{B.8}$$

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

C.1 Proof for proposition 1

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

$$\frac{\partial V^{S,P}(\bar{\mathbf{k}}^S)}{\partial \bar{k}_f^S} + \theta^A \left(\frac{\partial V^{S,P}(\bar{\mathbf{k}}^S)}{\partial \bar{k}_f^S} - \frac{\partial V^{S,P}(\bar{\mathbf{k}}^S)}{\partial \bar{k}_f^S} \right) = \hat{\mu}^S \frac{G(\bar{\mathbf{k}}_f^S)}{\partial \bar{k}_f^S} \tag{C.1}$$

$$r_f^{S,P}(1 + s_f^S) = \mu^S \frac{G(\bar{\mathbf{k}}_f^S)}{\partial \bar{k}_f^S} \tag{C.2}$$

There are two differences between (13) and (19) and (C.1)-(C.2). 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.

C.2 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* $\left\{\mathbf{t}^{i,z}, \mathbf{s}^i\right\}$*, 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* $\left\{\mathbf{c}^{i,z}, \mathbf{y}^{i,z}, \mathbf{m}^{i,z}\right\}$*, 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,*

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

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 (32) and the trade balance condition (38). 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

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

C.3 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

$$\frac{\partial u^{i,z}(\mathbf{c}^{i,z})}{\partial c_g^{i,z}} = \lambda^{i,z} p_g^{i,z} \tag{C.3}$$

The first order conditions for the production firms are given by

$$p_g^{i,z} \frac{\partial F_g^{i,z}(\mathbf{k}_g^{i,z}, \mathbf{l}_g^{i,z}, \mathbf{m}_g^{i,z})}{\partial m_{gh}^{i,z}} = p_h^{i,z} \tag{C.4}$$

$$p_g^{i,z} \frac{\partial F_g^{i,z}(\mathbf{k}_g^{i,z}, \mathbf{l}_g^{i,z}, \mathbf{m}_g^{i,z})}{\partial k_{gf}^{i,z}} = r_f^{i,z} \tag{C.5}$$

$$p_g^{i,z} = \frac{\partial F_g^{i,z}(\mathbf{k}_g^{i,z}, \mathbf{l}_g^{i,z}, \mathbf{m}_g^{i,z})}{\partial l_{g\ell}^{i,z}} = w_\ell^{i,z} \tag{C.6}$$

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

$$r_f^{i,P} = \mu^i \frac{\partial G^i}{\partial \bar{k}_f^i} \tag{C.7}$$

The remaining conditions are given by factor market clearing conditions and technology constraints(29)-(32), the income definitions (B.4)-(B.5) the goods market clearing condition(36), the trade balance condition and the definition of domestic prices (38)-(39) and the consumer budget constraint:

$$\sum_{g\in\mathcal{G}} p_g^{i,z} c_g^{i,z} = \Pi^{i,z} + T^{i,z} + \sum_{\ell\in\mathcal{L}} w_\ell^{i,z} \bar{l}_\ell^i \tag{C.8}$$

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

$$\frac{\partial V^{i,P}(\bar{\mathbf{k}}^i, \mathbf{x}^{i,P})}{\partial \bar{k}_f^i} = \hat{\mu}^i \frac{\partial G^i}{\partial \bar{k}_f^i} = \hat{\lambda}^{i,z} \hat{\phi}_f^{i,P} \tag{C.9}$$

$$\frac{\partial V^{i,z}(\bar{\mathbf{k}}^i, \mathbf{x}^{i,z})}{\partial x_g^{i,z}} = \hat{\lambda}^{i,z} q_g^{i,z} = \hat{\lambda}^{i,z} \hat{\delta}_g^{i,z} \tag{C.10}$$

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.

$$\frac{\partial u^{i,z}(\mathbf{c}^{i,z})}{\partial c_g^{i,z}} = \hat{\lambda}^{i,z}\hat{\delta_g}^{i,z} \tag{C.11}$$

$$\hat{\lambda}^{i,z}\hat{\delta}_g^{i,z}\frac{\partial F_g^{i,z}(\mathbf{k}_g^{i,z}, \mathbf{l}_g^{i,z}, \mathbf{m}_g^{i,z})}{\partial m_{gh}^{i,z}} = \hat{\lambda}^{i,z}\hat{\delta}_h^{i,z} \tag{C.12}$$

$$\hat{\lambda}^{i,z}\hat{\delta_g}^{i,z}\frac{\partial F_g^{i,z}(\mathbf{k}_g^{i,z}, \mathbf{l}_g^{i,z}, \mathbf{m}_g^{i,z})}{\partial k_{gf}^{i,z}} = \hat{\lambda}^{i,z}\hat{\phi}_f^{i,z} \tag{C.13}$$

$$\hat{\lambda}^{i,z}\hat{\delta}_g^{i,z} = \frac{\partial F_g^{i,z}(\mathbf{k}_g^{i,z}, \mathbf{l}_g^{i,z}, \mathbf{m}_g^{i,z})}{\partial l_{g\ell}^{i,z}} = \hat{\lambda}^{i,z}\hat{\varphi}_\ell^{i,z} \tag{C.14}$$

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 (29)-(32), the goods market clearing condition (36), the trade balance condition (38)

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.3) with (39) 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.10),(C.11) 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.5) and (C.6). Lastly we use (C.7) and (C.9) 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.10) and (C.11) 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.13) and (C.14) 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.9). 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 (36), 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.8). The remaining conditions are technology constraint and market clearing conditions which we have imposed on both problems.

C.4 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.23) 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.5 Proof for proposition 3

This 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.23) 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.6 Proof for proposition 4

Optimal investment policy The proof is identical to that presented in the main text in section 2 for the closed economy case.

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:

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

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 $\mathcal{E}_g^{Sj,z_1 z_2} = \sum_{h\in\mathcal{G}} \frac{\partial q_h^{j,z_1}}{\partial x_g^{Sj,z_2}} \frac{x_h^{Sj,z_1}}{q_g^{j,z_2}}$ 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

$$(1 - \theta^A)\frac{\partial V^{S,P}(\bar{\mathbf{k}}^S, \mathbf{x}^{S,P})}{\partial x_g^{S,P}} - \theta^S \frac{\partial V^{A,P}(-\mathbf{x}^{S,P}, \bar{\mathbf{k}}^A(\mathbf{x}^{S,P}))}{\partial x_g^{S,P}}$$

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

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:

$$\frac{\partial V^{S,P}(\bar{\mathbf{k}}^S, \mathbf{x}^{S,P})}{\partial x_g^{SA,P}} = \lambda^{S,P} p_g^{S,P} = \lambda^{S,P} q_g^{A,P}(1 + t_g^{SA,P}) \tag{C.21}$$
$$\frac{\partial V^{A,P}(-\mathbf{x}^{S,P}, \mathbf{k}^A(\mathbf{x}^{S,P}))}{\partial x_g^{SA,P}} = \lambda^{A,P} q_g^{A,P} \tag{C.22}$$

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

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

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

1. First one can show that:

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

   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

$$\frac{\theta^S}{(1-\theta^A)\lambda^{S,P} q_g^{A,P}} \sum_{f \in \mathcal{F}} \left[\frac{\partial V^{A,C}(-\mathbf{x}^{S,P}, \bar{\mathbf{k}}^A(\mathbf{x}^{S,P}))}{\partial \bar{k}_f^A} - \frac{\partial V^{A,P}(-\mathbf{x}^{S,P}, \bar{\mathbf{k}}^A(\mathbf{x}^{S,P}))}{\partial \bar{k}_f^A} \right] \frac{\partial \bar{k}_f^A}{\partial x_g^{SA,P}}$$

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

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

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

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

$$(1+t_g^{SA,P}) = (1+\bar{t}^{SA,P}) \left[1 + (1-\gamma^{SA,P})\mathcal{E}_g^{SA,PP} + \gamma^{SA,P} \sum_{f\in\mathcal{F}} \left[\frac{\bar{r}_f^{S,C}}{\bar{r}_f^{S,P}} - 1\right] \rho_{fg}^{SA} \frac{r_f^{A,P}\bar{k}_f^A}{q_g^{A,P} x_g^{SA,P}} + \psi^{SA}\mathcal{E}_g^{SA,PC}\right] \tag{C.23}$$

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

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

$$ \tag{D.20} $$

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 $\hat{q}^{j}_{jg} = 1$. This yields:

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

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

$$\left(\hat{r}^{S}_{g}\right)^{1-\alpha_{Sg}(1-\sigma_g)} = \left(\hat{P}^{S}_{Jg}\right)^{\alpha_{Jg}(1-\sigma_g)} \implies lnr^{S}_{g} = \frac{\alpha_{Jg}\left(1-\sigma_g\right) ln\hat{P}^{S}_{Jg}}{1-\alpha_{Sg}\left(1-\sigma_g\right)} = -\frac{DS^{S}_{g}}{EDFD^{S}_{g}} \tag{D.25}$$

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

$$u^{j,z} = c^{j,z}_{0} + \sum_{g\in\mathcal{G}_F}\left(a^{j}_{Sg}\right)^{-\frac{1}{\sigma}}\frac{\left(c^{j,z}_{Sg}\right)^{1-\frac{1}{\sigma}}}{1-\frac{1}{\sigma}} \tag{E.1}$$

where $\mathcal{G}_F$ refers to the aggregator sectors and Sg refers to Sovereign's variety associated with this sector. This implies that (59) can be derived from the household demand problem

$$\left(a^{j}_{Sg}\right)^{\frac{1}{\sigma}}\left(c^{j,z}_{Sg}\right)^{-\frac{1}{\sigma}} = p^{j}_{Sg} \implies x^{j,z}_{Sg} = c^{j,z}_{Sg} = a^{j}_{Sg}\left(p^{j,z}_{Sg}\right)^{-\sigma} = a^{j}_{Sg}\left((1+\tau^{j,z}_{Sg})p^{S,z}_{Sg}\right)^{-\sigma} \tag{E.2}$$

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

$$\bar{k}^{j} = c^{j,z}_{0} + \sum_{g\in\mathcal{G}_F}\frac{1}{b^{j}_{jg}}\frac{\left(y^{j,z}_{jg}\right)^{1-\omega}}{1-\omega}. \tag{E.3}$$

Equation (58) can be derived from the firm's maximization problem

$$p^{j,z}_{jg}\frac{1}{b^{j}_{jg}}\left(y^{j,z}_{jg}\right)^{-\omega} = 1 \implies p^{j,z}_{jg} = b^{j}_{jg}\left(y^{j,z}_{jg}\right)^{\omega} \tag{E.4}$$

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 (59) 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 $\left\{\hat{r}_{g,new}^S - \hat{r}_{g,guess}^S\right\}$ 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.[38] Logic chips are the chip seg-

[38]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 7.4.2 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.