

Economic sanctions as deterrents and constraints

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Abstract

This article analyses economic sanctions starting from the perspective of a target that has to allocate its income between spending on resources to pursue a contentious policy and consumption goods. By studying the target's consumption problem, it demonstrates how sanctions could backfire causing the target to shift its spending to resources to pursue the contentious policy, thereby increasing the severity of the policy. Whether this will come to pass depends on the elasticities of substitution, which are determined by the target's utility function. Therefore, even sanctions that seem like they could do no harm, such as embargoes on luxury goods consumed by only the target's dictator, could aggravate the level of the policy given the right utility function. Considering the target's consumption problem also illustrates how sanctions could (depending on the form of the target's utility function) reduce the resources it could allocate to pursuing the contentious policy, thereby moderating it. If the benefits of this constraint outweigh the costs of sanctions to the sender, it could be in the sender's best interest to impose sanctions. In these cases articulating a demand and waiting for the target to consider it would simply provide the target with additional time to continue the contentious policy, so the sender would impose constraining sanctions without warning. Constraining sanctions, therefore, provide an explanation for sanctions imposed without a threat stage. Constraining sanctions can occur even with complete and perfect information and may persist indefinitely, explaining the existence of long-term costly sanctions as well as sanctions that occur in cases of full information.

Keywords

costly conflict, deterrence, economic sanctions, game theory, threat stage

Introduction

Kim Jung-Un is a horrible human being. A despot known for his taste in fine wines, he runs a police state with rampant malnutrition and a GDP per capita of just \$1,700 per year (Sims, 2016; FAO, 2017; CIA, 2018). According to the United Nations, his human rights violations have no parallel in the modern world (UN Human Rights Council, 2014), and his pursuit of nuclear weapons could lead to a catastrophic war that would kill millions.

I propose that, depending on his utility function, it may be in the best interests of the United States to revise its sanctions on North Korea to allow Kim to purchase as many luxury goods as his heart desires. That such a statement seems to be folly is a result of an unexamined belief that the only purpose of sanctions is to punish the

target's government with a sufficiently strong penalty that it will be deterred from pursuing its contentious policy, and therefore the sender should employ the severest sanctions possible in order to convince the target to change its ways.

This belief stems from the idea that the target passively accepts the punishment. Previous models of economic sanctions tend to assume that the target receives a fixed amount of utility from pursuing the policy (Drezner, 2003). Sanctions lower the target's utility by a certain amount. If this amount is greater than the utility the target received from pursuing the policy, sanctions will deter the target from continuing with it. If the amount is

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smaller, the policy will continue. The more severe the sanctions, the more likely that the former will be true.

Unlike previous models of economic sanctions, this article considers how the target optimizes its consumption while under sanctions. Pursuing the policy requires the target to expend resources. Sanctions change the income the target has and the prices it faces, altering its incentives. As a result, they change the optimal level of spending on resources to pursue the policy. Depending on the price, cross-price and income elasticities of demand (which are determined by the form of the target's utility function) the imposition of economic sanctions could increase the level of the policy, decrease the level of the policy, or have no effect. Even seemingly benign sanctions – such as smart sanctions that prohibit the importation of luxury goods – could exacerbate the target's objectionable behavior if they cause the target to shift its spending away from consumer goods and devote more resources to the contentious conduct. Therefore it may be best to allow tyrants to spend their money on indulgences, even if doing so offends our innate sense of justice.

Since the effectiveness of sanctions is determined by the target's elasticities of demand and senders are not known to take these into account when imposing sanctions, the effects of sanctions could differ substantially from what the sender intended. Given the important goals with which sanctions are tasked – from ejecting Russian troops from Ukraine (Myers & Baker, 2014), to halting the Iranian nuclear weapons program (Gladstone, 2011) and preventing genocide in Darfur (Abramowitz & Lynch, 2007) – it behooves the sender to carefully consider how the target will react in order to ensure that sanctions are effective. The failure to do so in the past raises the possibility that previous sanctions have backfired, which could make sanctions appear to be a less effective tool than they are.

Because the target optimizes its spending on resources used to pursue the contentious policy in the face of economic sanctions, not only can sanctions be used to deter the target government from pursuing the policy, but they may also be able to constrain it. That is to say, sanctions may reduce the resources the target allocates to pursuing the policy, thereby lowering the level of the policy. Under the deterrence model of economic sanctions described in the previous literature, imposing sanctions always lowers the sender's utility. Under the constraint model developed in this article, the benefits to the sender from the sanctions-induced lower level of the policy could outweigh the sender's costs of imposing sanctions. Such sanctions are an inherently credible

threat and, if the target's discount factor is high enough, will deter it from pursuing the policy.

If the value of defecting is too high, the severity of punishment too low, or the target's shadow of the future too short, then sanctions imposed in the next round in retaliation for the target setting the level of the policy unacceptably high in this round may be ineffective at deterring it from setting the level unacceptably high. In this case the sender may impose economic sanctions straight away to constrain the target's ability to pursue to policy rather than sanctions designed to deter it. The sender may impose such constraining immediately, without waiting for the target to violate its demands. Consider sanctions on al-Qaeda. Given that members of the terrorist group vowed to give their lives in jihad against the United States, it is obvious that no possible punishment could deter them. As a result US sanctions upon them were imposed with only a few hours notice (Clinton, 1995).

Therefore, with the right utility functions and discount factors, even in a world with a unitary sender, a unitary target and complete and perfect information, it is possible to see sanctions along the equilibrium path of play. In fact, 34% of the sanctions cases in the Threat and Imposition of Economic Sanctions dataset were not preceded by a threat from the sender to the target demanding that it modify its behavior or face sanctions (Morgan, Bapat & Kobayashi, 2014). Instead the sender imposed sanctions immediately, an action that is antithetical to the idea of sanctions as deterrents. Morgan (2015) argues that these sorts of incapacitating sanctions are among the most important unexplained phenomena in the study of economic sanctions. Previous models of economic sanctions as deterrents cannot explain them. This article's model of economic sanctions as constraints can.

This article builds a parsimonious model with just two strategic actors, a sender and a target. Each player is a unitary actor whose domestic politics is not considered. While there is a long tradition of such models in the sanctions literature, there are also works that explain economic sanctions as products of the sender's domestic politics or the interaction of multiple countries in the international system. Kaempfer & Lowenberg (1988) argue that sanctions provide protectionist benefits to domestic industries which compete with imports from the target. Peksen et al. (2014) demonstrate that media coverage of human rights abuses drives US sanctions policy and Whang (2011) shows that sanctions increase presidential job-approval. Peterson (2013) explains that countries threatened with sanctions consider the sender's

past record of following through on its threats to assess its current credibility, thereby driving senders to impose sanctions in order to maintain their reputations. All of these articles provide a richer description of sanctioning behavior by presenting more complex models and can also account for maintaining unsuccessful sanctions on a target for many years. The contribution of this article is to expand our understanding of sanctioning behavior while maintaining the simple, two-player setup. Kustra (2022) considers how domestic political advocacy by immigrant groups affects sanctions and finds that the president caters to diasporas when they form an important voting block in swing states.

Previous models

Previous models of economic sanctions have typically treated sanctions as a cost that the sender imposes on the target to deter the target from engaging in behavior that the sender finds objectionable. Provided that the cost to the target of sanctions is greater than the cost of compliance, the target will comply; otherwise it will not. Consider, for example, the anti-Apartheid sanctions on South Africa imposed in 1985.¹ The point of the sanctions was to sufficiently harm the economic interests of the white ruling-class so they would prefer ending Apartheid to continuing to suffer under sanctions (Hufbauer et al., 2007: Case 62-2).

This idea of sanctions as deterrents drives the models of Eaton & Engers (1992), Hovi et al. (2005), Lacy & Niou (2004), and Tsebelis (1990). It has been cited in the United States' National Security Strategy (The White House, 2015) as the justification for imposing economic sanctions and, lest there be any doubt about how US senators view sanctions, a bill which would impose sanctions on Russia should it interfere in future US elections is called the Defending Elections from Threats by Establishing Redlines, or the DETER Act (Doff, 2018).

The classic deterrence model of sanctions, paraphrased here, begins with two players: the sender, denoted with a subscript s , and the target, denoted with a subscript t . Each player is a unitary actor, and their domestic politics are not considered.

The target wants to pursue a contentious policy. The policy affects the utility of both the sender and the target, denoted u_s and u_t respectively. Let the level of the policy

be measured by a , where $a \in \mathbb{R}$. The target wants a to be higher, the sender wants a to be lower.

$$\frac{\partial u_s}{\partial a} < 0, \quad \frac{\partial u_t}{\partial a} > 0$$

To ensure that a is set at a finite value, the model bounds a between a_{\min} and a_{\max} .

While the sender would like to affect a directly, setting the level of the policy is solely the prerogative of the target. Instead the sender can threaten to impose sanctions s if a exceeds a threshold set by the sender, \underline{a} . Sanctions, being costly, reduce the utility of both the target and the sender.

The game is an infinitely repeated version of the following stage game: (1) The sender determines whether to threaten to impose sanctions if a exceeds \underline{a} , and, if so, at what level to set \underline{a} . (2) The target considers the threat and sets a accordingly. (3) The sender observes a and determines whether to impose sanctions. Since sanctions are costly to the sender, the sender will only impose them to maintain the credibility of any subsequent threats to impose them.

In a world with complete and perfect information, under this model sanctions will not occur along the equilibrium path of play. Instead, the presence of sanctions is attributed to incomplete information that causes either the sender to misjudge the target's utility and demand a greater concession than the threat of sanctions can support or the target to misjudge the sender's resolve to impose sanctions. In these cases, the target's refusal to abide by the sender's demand will signal to the players that they have miscalculated and cause them to revise their expectations. Sanctions impositions in these instances should be short, and miscalculation cannot account for the multiyear and multidecade cases of sanctions that are often observed (Powell, 2004).

Even invoking incomplete information cannot explain why one-third of sanctions cases in the TIES dataset are not preceded by a threat to impose sanctions, something that this model requires. Furthermore, the model predicts that in the absence of a demand from the sender to restrain a the target will set a to a_{\max} . It also predicts that if the target changes the value of a , the only value to which it would change it to is \underline{a} . Sanctions, however, have been observed to cause the target to lower a from its initial value but not enough to reach \underline{a} , a result that this model cannot explain. For instance, the US sanctions on Cuba lowered its ability to support other communist governments and rebel movements, but did not – as the United States demanded – stop this support altogether (Hufbauer et al., 2007: Case 60-3). In other

¹ Previous sanctions on South Africa, such as the arms embargo on it, are examples of constraining sanctions.

cases, the target has increased a from its pre-demand level, such as when sanctions designed to support human rights cause the target's human rights record to deteriorate (Wood, 2008). This is incompatible with this model's prediction that in the absence of any demand from the sender to restrain a the target will set a to a_{\max} . The model that this article develops explains all these phenomena and shows that sanctions can occur in a world with unitary actors and complete and perfect information.

Current model

This article does not assume its model's functions take a particular form.

Again consider an infinitely repeated game. Like the previous model, let there be two players: the sender and the target. Each player is a unitary actor and their domestic politics are not considered. As before, the target wants to pursue a contentious policy that affects the utility of both players. Let the level of the policy be measured by a , where $a \in \mathbb{R}$. The target wants a to be higher, the sender wants a to be lower. But while the sender would like to affect the policy directly, its level is determined only by the resources, r_t , that the target expends on it. Resources are an intermediate good required to produce a , so $f(r_t) = a$. For example, if the policy was acquire nuclear weapons, resources could be conceptualized as fissile material. If the policy was abuse human rights, resources could be conceptualized as truncheons for the secret police. As the resources devoted to the policy increase, so does a .

$$\frac{\partial a}{\partial r_t} > 0$$

The target's utility, u_t , is a function of the level of the policy a and n goods, c_1, c_2, \dots, c_n . The target's utility function is differentiable with partial derivatives of

$$\frac{\partial u_t}{\partial a} > 0, \quad \frac{\partial u_t}{\partial c_{it}} > 0 \quad \forall i \in \{1, \dots, n\}.$$

Assume that the utility-maximizing level of $r_t, c_{1t}, \dots, c_{nt} > 0$, that is that the utility maximization problem always yields an interior solution.²

The target has an income of y_t and a budget constraint of $y_t \geq p_r r_t + p_{c1} c_{1t} + \dots + p_{cn} c_{nt}$, which should hold with equality in equilibrium. The target earns income by

exporting good c_{n+1} for which it receives a price of p_{cn+1} . Its income is therefore $y_t = p_{cn+1} c_{n+1t}$.

The sender's utility is a function of a and n other goods, c_{n+1}, \dots, c_{n+m} . Its utility function is differentiable with partial derivatives of

$$\frac{\partial u_s}{\partial a} < 0, \quad \frac{\partial u_s}{\partial c_{is}} > 0 \quad \forall i \in \{n+1, \dots, n+m\}.$$

The sender has an income of y_s and a budget constraint of $y_s \geq p_{cn+1} c_{n+1s} + \dots + p_{cn+m} c_{n+ms}$, which should hold with equality in equilibrium. It earns income by exporting r and c_1 , for which it receives prices of p_r and p_{c1} , respectively. Its income is therefore $y_s = p_r r_s + p_{c1} c_{1s}$.

If the model included just the sender and the target, then sanctions that banned the trade in a good would cause the quantity of the good to fall to zero. To prevent this the model includes third countries, which are not strategic actors, that import and export all of the goods in the model. The prices of the goods are set in international markets. This allows sanctions to increase the price the sender or the target pays for imports and to lower the price they receive for exports, rather than causing the quantity traded to fall to zero. Since the third countries are not strategic players, their behavior is not modeled.³

For any good it is possible to purchase or sell a fraction of a unit, that is to say $c_1, \dots, c_{n+m}, r \in \mathbb{R}_+$.

Let the target's discount factor be δ_t and the sender's discount factor be δ_s . Both players' discount factors are greater than 0 and less than 1.

Finally the values of all the coefficients are common knowledge and immediately after a player has made a move its action is observable by all the players. Both players have perfect recall of previous actions.

The game is an infinitely repeated version of the following stage game: (1) The sender decides whether to impose sanctions in this round. It also decides whether to threaten the target with sanctions in the next round if, in the current round, a exceeds a threshold, \underline{a} , and, if so, at what level to set \underline{a} . (2) The target considers the sender's threat and sets the levels of $r_t, c_{1t}, \dots, c_{nt}$ in its consumption bundle. The value of a for the round is realized given the value of r_t that the target sets.

² The restriction that a positive amount of a good is consumed in equilibrium assumes that there is not a comprehensive embargo on the good preventing any consumption of it. In the event of such an embargo, a good's level of consumption could equal zero.

³ A more detailed model would include a general equilibrium model of world trade that takes into account transportation and smuggling costs to analyze how sanctions cause the prices that the sender faces to differ from those that the target faces. While such a model would have the benefit of being more realistic, it would come at the expense of tractability. Therefore, a more parsimonious model that does not explicitly calculate these differences will be used.

But what will the optimal threat of sanctions be? Will the target always acquiesce to that threat? Are there cases where sanctions will occur in equilibrium? Like most games, it will be easiest to work backwards and consider how the target responds to sanctions first.

The target's response to sanctions

First, consider sanctions which affect only the price of r to the target. In this case, the result is clear. Increases in p_r cause a to decrease.⁴ These are the only type of sanctions that will have an unambiguous effect on the level of the policy.

Sanctions that prohibit the export of goods that could be used to further policies to which the sender objects are common. The United States Munitions List, which is only one part of the US government's export control regulations, comprises 21 categories of goods from fighter jets to submarines. These restrictions were critical to enabling the United States to 'maintain a strategic and tactical advantage without having to match the Warsaw Pact nations' troop strength in the field' (Wallerstein, 2009: 11). Since the end of the Cold War, these restrictions have retarded (although not always prevented) the dissemination of weapons of mass destruction. However, because the restrictions apply to the vast majority of countries they are so unremarkable as to be often excluded from the sanctions datasets. Were they to be included, they would require the accepted belief that sanctions are rarely effective to be reconsidered.

Winston Churchill noted that iron ore from Scandinavia was vital to the Nazis and curtailing access to it would hobble the German war effort. There is 'no other measure [...] open to us for many months to come which gives so good a chance of abridging the waste and destruction of the conflict, or of [...] preventing the vast slaughters which will attend the grapple of the main armies' (Churchill, 1948: 490).

Different types of policies may show different responsiveness in translating resources into policy outcomes. The model provides for this by allowing the function $f(r) = a$ to vary by the type of policy. The resources discussed above all focus on the most obvious example,

⁴ This assumes that the price elasticity of r , $\frac{\partial r}{\partial p_r} \frac{p_r}{r}$, is less than zero. This is identical to saying that r is not a Giffen good, that is a good whose consumption increases with its price. If r were a Giffen good, then increasing the cost of resources would increase the level of the policy. Giffen goods, however, are at a minimum exceedingly rare and, according to some scholars, may exist only in theory (Jensen & Miller, 2008).

resources that support military might, and therefore would affect policies such as containing military behavior, resolving territorial disputes, and retaliating for alliance choice.

It could be argued that other sorts of policies, such as abusing human rights, are less dependent on imported resources. A secret policeman can always beat a dissident with his fists if a truncheon isn't available, and it is simple enough to manufacture truncheons domestically if they cannot be imported. Yet even in this case outside resources may play a role. The People's Republic of China has built a dystopian surveillance state by combining millions of cameras with facial recognition software in order to track – and thereby more effectively oppress – dissidents, ethnic minorities, and others that the regime deems undesirable (Harwell & Dou, 2020). While the final assembly of the computers and cameras and the final design of the software is done in China, the hardware is built out of components manufactured across east Asia and the software was developed out of earlier algorithms designed in the United States. Halting the flow of these parts would have precluded the building of this system and forced the Chinese government to rely upon older, more expensive and less effective methods of tracking and oppressing their people.

Even if the target could be completely self-sufficient, the principle of comparative advantage means that the target will be better at manufacturing some goods than others. Therefore it should specialize in producing the goods in which it has a comparative advantage and trading part of this output for goods in which it has a comparative disadvantage. By doing so, the target will maximize its production. Even if the target could produce r itself, unless it had a comparative advantage in producing r , choosing to produce r domestically rather than import it would lower the target's productivity. As a result, sanctions on r would still have an effect on the level of a .

Beyond simply changing the price of r , sanctions often target the consumption good c_1 as well. In these cases, the effect of sanctions on a cannot be determined a priori. Instead it will depend on whether the cross-price elasticity of demand, which is defined as $\frac{\partial r}{\partial p_{c_1}} \frac{p_{c_1}}{r}$, is positive or negative. Since r and p_{c_1} must both be positive, the sign is determined by the partial derivative $\frac{\partial r}{\partial p_{c_1}}$. This, in turn, is determined by the form of the target's utility function. This article did not assume that the target's utility function took a specific form precisely because it did not want to presume what the sign would be a priori.

Consider sanctions which raise the price of the consumption good c_1 to the target. If c_1 is a substitute for r ,

that is to say $\frac{\partial r}{\partial p_{c_1}} > 0$, then the target will increase its spending on r , causing a to rise. In short, sanctions could cause exactly what they were meant to prevent.

The international community is fond of imposing sanctions on luxury goods, arguing that prohibiting the sales of Rolexes and Rolls-Royces will harm the government but not the general population. For instance, the United States banned the export of jewelry, gold watches, fur coats, and other opulent items to North Korea (Department of Commerce, 2007). ‘Whether it will work, we don’t know,’ explained a former State Department official, but ‘it can’t hurt’ (Glaister, 2006). Similarly, the European Union prohibited the sale of limousines, caviar, cigars, and fine wines to Syria. Announcing the sanctions, the EU high representative for foreign affairs and security policy said that the union had ‘carefully calibrated today’s decision to avoid affecting the Syrian people’ (Council of the European Union, 2012).

Wintrobe (1990) says that dictators keep power through two methods: bribery and repression. In arguing for these types of sanctions the state department official said ‘[I]f you take away one of the tools of [Kim’s] control, perhaps you weaken his leadership’ (Glaister, 2006). It is possible that restricting the sale of the luxury goods he uses to curry favor with his winning coalition and maintain power could weaken Kim. But it could also cause him to become more repressive in order to hold on to power (Park & Choi, forthcoming). If the purpose of sanctions was to reduce Kim’s repression, then they could have precisely the opposite effect. Peksen (2009) provides evidence that the latter is what often occurs. Looking at cases of sanctions from 1981 to 2000, he finds that sanctions increase the number of political prisoners, the use of torture, and the number of extrajudicial killings. So, while it is deeply emotionally unsatisfying, it may be in the best interests of the sender to let the dictator have his baubles. This logic extends to any good which is a substitute for r , that is to say any good for which an increase in its price causes the quantity of r to increase.

Similarly, conventional and nuclear weapons both provide protection from attack. If the sender imposes an arms embargo in order to prevent the target from acquiring a nuclear weapon and the embargo raises the price of conventional weapons more than the price of nuclear weapons then the target may choose to shift its spending to its nuclear weapons program, aggravating the very policy that the sanctions were meant to curtail.

If r were a complement of c_1 , that is to say that $\frac{\partial r}{\partial p_{c_1}} < 0$, then increasing the price of c_1 would cause the

target to decrease spending on r . Therefore, embargoes that increase the price of c_1 would lower a . In this case it may seem beneficial to go beyond simply increasing the price of c_1 to imposing an air-tight embargo that prevents the target from purchasing any c_1 . The logic of sanctions does not extend this far. If an air-tight embargo that prevented the target from purchasing any c_1 were possible, it would cause the target’s spending on c_1 to be zero. The target would then reallocate its spending, potentially increasing r and thereby a . So even if the cross-price elasticity is negative, it may be best to use sanctions only to increase the cost of the dictator’s baubles but not ban them entirely.

The sender may also impose sanctions on the importation of the consumption good c_{n+1} from the target to decrease the income the target has to pursue the policy. It may appear that lowering the government’s income would cause r , and thereby a , to fall. This assumes, however, that the income elasticity of r , $\frac{\partial r}{\partial y}$, is positive which is not necessarily the case. In the event that the income elasticity was negative, then as the import sanctions decreased the target’s income, its spending on r would rise, increasing a .⁵ For instance, dictators understand that economic crisis often leads to attempted coups and revolutions and therefore they increase spending on their secret police just as the rest of their countries’ economies are shrinking due to sanctions (Escribà-Folch, 2012). Similarly, they may increase repression of unpopular ethnic groups in order to divert attention from their economic performance.

In short, only in cases where sanctions affect only p_r can the effect of sanctions on a be determined in abstraction. As soon as sanctions affect the price of the good c_1 or the target’s income y , their effect on the optimal level of r , and therefore a , will be determined by the cross-price and income elasticity of demand, respectively. These elasticities are themselves determined by the target’s utility function. Unlike many cases of counter-intuitive results, the results here are not driven by preference aggregation but rather occur in a simple model with unitary actors.

Finally, if the elasticity in question equaled zero, then sanctions would have no effect on a .

In so far as the propositions expressed here flow directly from the formulas for price-elasticity, cross-price elasticity,

⁵ In the limiting case where the sender was able to reduce the target’s income to zero, concerns about the income elasticity of r would be irrelevant. In this case r would equal zero and therefore a would be at its minimum.

and income elasticity, they are tautologically true and do not require a formal proof.

Deterrence sanctions

Any value of r greater than zero lowers the sender's utility, causing it to consider sanctions to affect r and thereby a . In theory, sanctions could be any policy that affects trade in order to alter a . For instance, the sender could impose a tariff on imports from the target or exclude a portion of them using a quota in order to bend the target to its will. In practice, sanctions have been bans on trade imposed on one or more goods. As Spindler (1995) notes, '[N]o trading with the enemy' is a more politically viable slogan than '[N]o trading with the enemy except at better prices.'

The sender now faces a choice of prohibiting trade in any or all of the goods c_1, c_{n+1} and r . Denote sanctions as a three-element vector, s , where each element takes a value of 0 or 1 based on whether the corresponding good is under sanctions. Let s_0 denote the case where none of the goods are under sanctions and let s_i be any of the other seven possible cases.

The sender calculates the effect of sanctions on prices for each of the goods. Using this information, the sender estimates how the target will alter its utility-maximizing consumption bundle for each of the possible combinations of sanctions and then estimates each player's utility for each of the possibilities. Let a_i^* be the target's utility-maximizing level of a under sanctions i and let a_0^* be the optimal level of a in the absence of sanctions. Since a is solely a function of the target's spending on r , for simplicity refer to the target playing a rather than the level of r which corresponds to the desired level of a . Assume that if the target sets a to its utility-maximizing level, the sender's utility under sanctions is lower than its utility in the absence of sanctions, $u_s(s_0, a_0^*) > u_s(s_i, a_i^*) \forall i$.

Despite the fact that sanctions lower the sender's utility, it may be able to use the threat of sanctions s_j to deter the target from setting a above a certain threshold. Denote this case of sanctions as s_j and, for the remainder of this section, distinguish it from all other cases of sanctions, $s_i \neq s_j$. Define a_j as a threshold level of a , where $a_j < a_0^*$. If the threshold is exceeded, the sender will play s_j . Consider the following strategy profile:

Strategy profile 1

Sender: If in any previous round the sender played s_0 , the target played $a > a_j$ and the sender has not subsequently played s_j , then play s_j . If the target has never

played $a > a_j$ in response to s_0 , or if the target has played $a > a_j$ in response to s_0 and the sender has subsequently played s_j , then play s_0 .

Target: If the target has previously played $a > a_j$ in response to s_0 , the sender has not subsequently played s_j , and in the current round the sender plays s_0 , then play a_0^* . If the target has never played $a > a_j$ in response to s_0 or if the target has played $a > a_j$ in response to s_0 and the sender subsequently played s_j , and the sender plays s_0 in the current round then play a_0 . If the sender plays s_j , play a_j^* . If the sender plays s_j , play a_j^* .

In plain English, this is a strategy profile for deterrence sanctions, demonstrating how this model can account for the classic view of sanctions presented in section II. The sender will sanction the target with s_j if the target previously set the level of the policy above the threshold and the sender has not yet sanctioned the target. Otherwise the sender will not sanction. The target will set the level of the policy to the threshold if the sender does not impose sanctions and if the sender has always eventually sanctioned the target with s_j for setting the level of the policy above the threshold. The target will set the level of the policy to its utility-maximizing level in the absence of sanctions if the sender does not impose sanctions and has not yet sanctioned the target with s_j for previously setting the level of the policy above the threshold. The target will set the level of the policy to its utility-maximizing level given the type of sanctions imposed if the sender sanctions it.

The equilibrium path of play is for the target to accede to the sender's demand and set the level of the policy at the threshold, $a = a_j$, and for the sender not to impose sanctions. Unlike some models, deterrence sanctions are never imposed along the equilibrium path of play in this model because perfect and complete information allows players to predict the other's behavior. As a result the sender sets the threshold as low as it can while still ensuring that it is in the target's interest to comply and the target, knowing that the sender is willing to carry out the threat and that sanctions are not in its interests, complies.

Formally, for this to be a subgame-perfect Nash equilibrium two conditions must be met. First, the sender must not defect from punishing when it is required to do so. The value of punishing using sanctions s_j is $u_s(s_j, a_j^*) + \delta_s u_s(s_0, a_j) + \frac{\delta_s^2 u_s(s_0, a_j)}{1 - \delta_s}$. The value of playing another set of sanctions s_i is $u_s(s_i, a_i^*) + \delta_s u_s(s_j, a_j^*) + \frac{\delta_s^2 u_s(s_0, a_j)}{1 - \delta_s}$, while the value of not imposing sanctions at all is $u_s(s_0, a_0^*) + \delta_s u_s(s_j, a_j^*) + \frac{\delta_s^2 u_s(s_0, a_j)}{1 - \delta_s}$. Note that the final

term of all the values is the same. Therefore, for the threat to be credible, Conditions (1) and (2) must hold,

$$u_s(s_j, a_j^*) + \delta_s u_s(s_0, \underline{a}_j) \geq u_s(s_i, a_i^*) + \delta_s u_s(s_j, a_j^*) \quad \forall i \neq j \quad (1)$$

$$u_s(s_j, a_j^*) + \delta_s u_s(s_0, \underline{a}_j) \geq u_s(s_0, a_0^*) + \delta_s u_s(s_j, a_j^*). \quad (2)$$

Whether the conditions on the sender hold will depend on four factors: (i) the maximum sustainable demand for the level of the policy, \underline{a}_j , (ii) the sender's utility when punishing with sanctions s_j , $u_s(s_j, a_j^*)$, (iii) the sender's utility when using another set of sanctions to punish, $u_s(s_i, a_i^*)$, or not punishing at all, $u_s(s_0, a_0^*)$, and (iv) the sender's discount factor, δ_s . As the sender's discount factor increases, it will prioritize long-term benefits over short-term gains and be more likely to bear the costs of punishing now for a lower a in the future. As the utility it receives when it imposes sanctions s_j approaches or exceeds the utility it gets from imposing s_i or not imposing sanctions at all, s_0 , the sender becomes more willing to follow through on its threat. Finally, as the benefits the sender extracts from its strategy in terms of lowering \underline{a}_j increase, its desire to proceed with this strategy does too.

The second condition is that the punishment be large enough to convince the target to change its ways. If the target heeds the sender's demand and in the absence of sanctions plays $a \leq \underline{a}_j$ it will receive $u_t(s_0, \underline{a}_j) + \frac{\delta_t^2 u_t(s_0, \underline{a}_j)}{1 - \delta_t}$. If it does not, its utility-maximizing level of a is a_0^* . Playing this will give it $u_t(s_0, a_0^*) + \delta_t u_t(s_j, a_j^*) + \frac{\delta_t^2 u_t(s_0, \underline{a}_j)}{1 - \delta_t}$. Again, note that the final term of the values is the same. Therefore, for the target to comply with the sender's demand, Condition (3) must hold.

$$u_t(s_0, \underline{a}_j) + \delta_t u_t(s_0, \underline{a}_j) \geq u_t(s_0, a_0^*) + \delta_t u_t(s_j, a_j^*). \quad (3)$$

Because the sender will want to extract the maximum concession possible from the target, this expression will hold with equality for the level of a that the sender demands. The lowest level of a that the sender could successfully demand will depend on three factors: (i) the target's utility of defecting $u_t(s_0, a_0^*)$, (ii) the target's utility when being punished $u_t(s_j, a_j^*)$, and (iii) the target's discount factor. As the utility from defecting decreases, and as the harm from the punishment increases, the target will be willing to acquiesce to lower levels of a in order to avoid sanctions. Moreover as the target's discount factor increases, it will prioritize the long-

term benefits of complying over the short-term benefits of defecting, again allowing the sender to extract lower levels of a in return for the absence of sanctions.

For a formal proof that provided Conditions (1), (2), and (3) hold Strategy profile 1 is an SPNE, please see the Online appendix.

Constraining sanctions

The sanctions policy presented in Strategy profile 1 demonstrates that this article's model can account for the standard case of deterrence sanctions that has been discussed in the previous literature: a threat, which is costly to both the sender and the target, designed to dissuade the target from engaging in its contentious policy. And like all cases of threats of costly punishments, in a Coasian world the threat should not be carried out along the equilibrium path of play.

How then do we account for the numerous cases of sanctions that we observe? While miscalculation on the part of the sender or the target could account for an occasional short period of sanctions, there are numerous cases of multidecade sanctions that cannot be explained by miscalculation. There are also many cases of sanctions being imposed suddenly, without the sender issuing a threat or giving the target time to comply. This model provides an answer.

There may exist a case where the benefits of sanctions to the sender in terms of lower a match or outweigh their costs to the sender in terms of lower income and/or higher prices, making the sender weakly prefer these sanctions to the status quo. Denote this case of sanctions as s_k and, again for the remainder of this section, distinguish it from all other cases of sanctions, $s_i \neq s_k$. Let the sender weakly prefer s_k to status quo, so $u_s(s_k, a_k^*) \geq u_s(s_0, a_0^*)$. Let the sender also weakly prefer s_k to all other cases of sanctions $u_s(s_k, a_k^*) \geq u_s(s_i, a_i^*) \quad \forall i \neq k$. In that case a threat to impose s_k for any number of periods as a punishment for defection would be credible since the sender weakly prefers them to the non-cooperative outcomes. This allows the sender to play a grim-trigger strategy, where it will punish the target with sanctions in perpetuity should the target not meet its demands.

Strategy profile 2

Sender: If in any previous period the sender played s_0 and then the target defected by playing $a > \underline{a}_k$, play s_k forever. If the target has never defected by playing $a > \underline{a}_k$ when the sender played s_0 , play s_0 .

Target: If the target defected in any previous round by playing $a > \underline{a}_k$ in response to the sender playing s_0 , and the sender defects on punishing in the current round by playing s_0 , play a_0^* . If $s_0, a > \underline{a}_k$ was not played in any previous round, and the sender plays s_0 in the current round, play \underline{a}_k . If the sender plays s_i play a_i^* , and if the sender plays s_k play s_k^* .

In plain English, the sender imposes everlasting sanctions s_k if, in the absence of sanctions, the target ever set the level of the policy above the threshold. Otherwise the sender does not impose sanctions. The target will set the level of the policy to the threshold if the sender has not imposed sanctions and if the target has always previously set the level of the policy within the threshold in the absence of sanctions, so that the lack of sanctions in this round does not mean the sender is defecting on sanctioning. The target will set the level of the policy to its utility-maximizing level in the absence of sanctions if the sender does not impose sanctions and the target has previously set the level of the policy above the threshold in the absence of sanctions, so that the lack of sanctions in this round means the sender is defecting on sanctioning. The target will set the level of the policy to its utility-maximizing level given the type of sanctions imposed if the sender sanctions it.

The equilibrium path of play is for the target to set the level of the policy at the threshold demanded by the sender and for the sender not to impose sanctions. Complete and perfect information allows each player to predict the other's behavior. As a result the sender sets the threshold as low as it can while still ensuring that it is in the target's interest to comply and the target, knowing that the sender is willing to carry out the threat and that sanctions are not in its interests, complies.

Formally, for this to be a subgame-perfect Nash equilibrium, three conditions must hold. Unlike the previous strategy profile, the threat to impose sanctions in this case is inherently credible since $u_s(s_k, a_k^*) \geq u_s(s_0, a_0^*)$ and $u_s(s_k, a_k^*) \geq u_s(s_i, a_i^*) \forall i \neq k$. Instead, the concern is that the sender will impose sanctions even when it has agreed not to do so. To prevent this, \underline{a}_k must be small enough that

$$u_s(s_0, \underline{a}_k) \geq u_s(s_i, a_i^*) \forall i \neq k, \quad (4)$$

$$u_s(s_0, \underline{a}_k) \geq u_s(s_k, a_k^*). \quad (5)$$

The lower the level of \underline{a}_k , and the greater the harm caused by sanctions s_i and s_k to the sender, the more likely these conditions will hold.

The second condition is that the threat of sanctions must deter the target from defecting. If the target acquiesces it receives $\frac{u_t(s_k, \underline{a}_k)}{1 - \delta_t}$. If it defects it receives $u_t(s_0, a_0^*) + \frac{\delta_t u_t(s_k, a_k^*)}{1 - \delta_t}$. Therefore, for the target to comply Condition (6) must hold.

$$\frac{u_t(s_k, \underline{a}_k)}{1 - \delta_t} \geq u_t(s_0, a_0^*) + \frac{\delta_t u_t(s_k, a_k^*)}{1 - \delta_t} \quad (6)$$

The maximum concession the sender will be able to extract from the target will be when Condition (6) holds with equality. Like the previous case of deterring sanctions, the level of \underline{a}_k will depend on the target's utility when it defects, $u_t(s_0, a_0^*)$, its utility when it is punished, $u_t(s_k, a_k^*)$, and its discount factor, δ_t . Provided that there exists an \underline{a}_k that satisfies Condition (6) and which the sender weakly prefers to the imposition of sanctions, then this strategy profile is a subgame-perfect Nash equilibrium. For a proof of this please see the Online appendix.

The requirements of Conditions (4) and (5) that $u_s(s_0, \underline{a}_k) \geq u_s(s_k, a_k^*)$ and $u_s(s_0, \underline{a}_k) \geq u_s(s_i, a_i^*) \forall i \neq k$ set an upper limit on \underline{a}_k . If the target's value of defection is too high, the severity of its punishment is too low, or its shadow of the future too short, then the minimal concession required under these conditions cannot be sustained by the target. The sender will know that any promise by the target to cooperate cannot be trusted and that the target will defect at the first opportunity.

In the previous section, where the sender's utility under the status quo was always higher than its utility under sanctions, $u_s(s_0, a_0^*) > u_s(s_i, a_i^*) \forall i$, if there did not exist an \underline{a} that satisfied Conditions (1) through (3), then sanctions would not be an effective foreign policy tool. In this case, because the sender weakly prefers imposing sanctions to the status quo, $u_s(s_k, a_k^*) \geq u_s(s_0, a_0^*)$, if the target is unable to commit to sufficiently lowering a then the sender would be willing to impose sanctions along the equilibrium path of play.

Strategy profile 3

Sender: Play s_k .

Target: If the sender plays s_k , play a_k^* . If the sender plays s_0 , play a_0^* . If the sender plays s_i , play a_i^* .

For a formal proof that Strategy profile 3 is an SPNE, please see the Online appendix. In plain English, the sender will always impose sanctions. The target will set the level of the policy to its utility-maximizing level of the policy given the sanctions imposed, if any.

Unlike the previous strategy profile, the equilibrium path of play is for the sender to always impose sanctions s_k and the target to always set the level of the policy to the target's utility-maximizing level given sanctions s_k . Cooperation cannot be maintained because the target values the benefits of defecting today more than the cost of being sanctioned tomorrow. This could be because the benefits of defection are large compared with the punishment or it could be because the target does not put much value on the future. Given complete and perfect information the sender knows this and will impose sanctions immediately instead of trying to cooperate. Despite their costs, the sender prefers sanctions s_k to no sanctions at all because of the constraining effect of s_k on the level of the policy and so imposes sanctions in every round.

This equilibrium explains the sanctions against Osama bin Laden and al-Qaeda. Inheriting a fortune of \$25 to \$30 million, bin Laden preferred to live in a cave in Afghanistan and risk his life fighting first the Soviet Union and then the United States (*Economist*, 2011). Not only did his followers also embrace the harsh conditions, they were even more willing to face death with many eager to become martyrs and volunteering for suicide missions. Obviously, sanctions against them could not impose any greater hardship than they had taken on already. Because sanctions' ability to punish in the future was limited, the SPNE from Strategy profile 2 was unavailable. As a result, the sanctions that the United States imposed were not designed to deter bin Laden and al-Qaeda but to constrain their resources to prevent them from launching further attacks.

Constraining sanctions are common in cases where the value of a single shot defection is high relative to the punishment. This is the reasoning behind imposing export restrictions on military technology: that any credible threat of post-hoc punishment will not be sufficient to deter a country's enemies from using its weaponry against it and therefore the country should not arm its foes no matter what assurances the foes give them.

The use of sanctions as constraints also explains sanctions against groups with low discount factors. The target's discount factor is driven by the target's preferences and expectations of the future. Identically situated players vary in their desire to forgo utility today in return for utility tomorrow due to different preferences. Furthermore, players with the same preference may vary in their likelihood of dying. Individuals who are more likely to die before tomorrow comes will place a lower value on future consumption to reflect the fact that they are less likely to live to receive it. For instance, given their often precarious strategic situation, rebel movements have low

discount rates and cannot be trusted to keep promises they make to respect human rights and obey the laws of war. Instead, the United Nations has turned to prohibiting the sale of conflict diamonds that the groups use to support themselves, in order to lower their incomes and thereby constrain their activities (Lopez, 2012).

Threatening the target that if it does not change its policies it will be sanctioned in the next round merely allows the target to continue its contentious policy in this round. As a result, the constraining sanctions SPNE described in Strategy profile 3 will come without warning. Of the 1,412 cases in the Threat and Imposition of Economic Sanctions dataset (Morgan, Bapat & Kobayashi, 2014), just over one-third do not have a threat stage. Instead, the sender imposed economic sanctions without warning. The idea of economic sanctions as deterrents cannot explain cases of sanctions where the sender did not attempt to deter the target. The model presented here can.

Taken together, these results should cause us to reconsider the definition of successful economic sanctions. As the discussion of the target's behavior in section IV showed, provided that the demand elasticity in question is negative, any restriction that raises the price the target faces or reduces the income that it earns will decrease the level of the contentious policy. This means that policies that are not typically thought of as cases of economic sanctions may need to be included in the definition in order to achieve a more accurate picture of the ability of senders to use economic statecraft to influence targets' behavior. The SPNEs subsequently presented in sections V and VI show how the target's and the sender's reactions to sanctions, combined with their discount factors, determine what levels of \underline{a} are achievable. Therefore, while any case of sanctions will reduce the level of the contentious policy so long as the demand elasticity is negative, whether or not the sanctions will reduce the level sufficiently for the sanctions to be deemed a success is just as much a function of the desired level of the policy as of the sanctions themselves.

Conclusion

Despite the fact that economic sanctions have been a staple of US foreign policy since the end of the Cold War, according to the previously cited State Department official, whether they work, we don't know, but they can't hurt. This article builds a model of how sanctions operate and in so doing determines under which circumstances they will be effective. It begins with just two unitary strategic actors, a sender and a target. It then examines how the target allocates its


resources and finds that, depending on the form of the target's utility function, sanctions could cause the target to increase the level of the policy, decrease the level of the policy, or have no effect. This suggests that policy-makers should carefully consider how sanctions will affect the target's behavior before imposing sanctions since, contrary to what the State Department official said, even smart sanctions can hurt. It also raises the possibility that previous cases of economic sanctions have been ineffective because senders failed to take the target's reaction into account.

The article then uses the insights gained about how the target will respond to sanctions to understand how the sender will use them. In the event that sanctions are sufficiently harmful to the target and the target's discount factor is sufficiently high, then the sender may be able to use the threat of sanctions to pressure the target to moderate the level of its contentious policy. This is the classic deterrence effect of economic sanctions. The fact that the target optimizes the allocations of its resources raises another possibility: that the benefit of sanctions to the sender in terms of lower a outweighs the harm of lower income and/or higher prices. As a result, the sender may prefer the presence of sanctions thereby showing how economic sanctions may not only be used to deter but also to constrain. These constraining sanctions can occur without a threat stage, in cases of complete and perfect information and last for many years. Previous models of economic sanctions could not explain them. This article's model does.

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