War, Transfers, and Political Bias*

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Abstract

We examine the incentives for countries to go to war as they depend on the comparison of how much their pivotal decision-makers have at risk compared to how much they stand to gain from a war. How this ratio compares to the country at large is what we term "political bias". If there is no political bias (a case that we loosely relate to a "pure democracy"), then there are always payments that one country would like to make to the other that will avoid a war. If there is a bias on the part of one or both countries, then war can result and in some cases cannot be prevented by any transfer payments. We also examine how stability among many countries depends on bias, as well as the importance of alliances in achieving stability.

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1 Introduction

The rich history of war provides evidence of its devastating consequences and of the wide variety of circumstances that lead to it.[1] While there is much that we know about wars, there is still much to be learned about how the choices to go to war differ across countries and circumstances, and in particular how this relates to economic situations and political regimes. Although religious and ethnic conflicts have played key roles in many wars, balance of power, territorial disputes, expansion of territory, and access to key resources or wealth are often either involved or the primary driving force behind wars.[2] In this paper, we build a model of war based on bargaining that serves as a basis for understanding how political structure (crudely modeled) interacts with economic incentives to determine when wars will occur.

Our model of war is described as follows. Two countries are faced with a possible war, and each knows their respective probability of winning which depends on their respective wealth levels. If a war ensues, each country incurs a cost, and then the victor claims a portion of the loser's wealth. The incentives of each country thus depend on the costs, the potential spoils, and the probability that each will win. If either country wishes to go to war then war ensues. Countries can offer to give (or receive) some transfer in order to forgo a war.

The way in which we tie the analysis back to political structure is crude but powerful. We model a country's decisions through the eyes of the pivotal decision-maker in the society. In particular, the ratio of relative share of benefits compared to share of costs of this pivotal agent is thus a critical determinant of a country's decisions. We call this ratio the "political bias" of the country. If it is close to one, then the country's critical decision maker's relative benefits/costs are similar to the country at large. If this ratio is significantly different from one, then we say that the country is "politically biased."

We show that if countries are politically unbiased, then war can be avoided, provided the countries can make transfers and provided they can commit to peace conditional on receiving transfers. If either country is politically biased, then war can ensue, and whether or not it does depends on the specifics of the war technology, relative wealths, potential costs and spoils of war, and the size of the biases. We also study such bargaining when neither country can commit to peace after receiving transfers. Here the incentives are more complicated, as it must be that after receiving a transfer, a war would no longer be worthwhile for the

[1]See, for example, Blainey (1973) and Kaiser (1990).

[2]Resources and wealth are the focus of much of the recent formal literature on war. See the discussion and references below.

potential aggressor. Using this model, we also discuss the stability of peace among larger numbers of countries, and allowing for alliances.

Political bias essentially embodies anything that might lead to different incentives for the critical decision maker relative to the society as a whole. For instance, in a totalitarian regime, it might be that a leader can keep a disproportionate share of the gains from a war. It might also be that the leader sees other gains from war, in personal recognition or power. Similarly, if the military is leading a country, then it may be that military leaders gain disproportionately from war in terms of accumulated power, or even in keeping their troops occupied. These effects are not unique to autocratic or oligarchic regimes, but can also occur in democracies. It might be that an executive stands to gain in the possibility of reelection based on a war, or has other indirect benefits in terms of benefiting friends or companies to which he or she has ties. It is also important to note that bias can also go in the other direction. For instance, if a democratic leader risks losing office if a war is lost then that might lead to him or her to over-weight the costs of war relative to gains, resulting in a bias factor less than one.

There are three stylized observations that our model has implications regarding.

The first is the so-called "Democratic Peace" or "Liberal Peace" observation, where two democracies are much less likely to go to war with each other than are two countries when at least one is not a democracy (e.g., see Doyle (1986) and Russett (1993)). If one interprets unbiased countries to be democracies, then in our model, two democracies would never go to war with each other. Specifically, we show that at most one of two unbiased countries will want to go to war, and if binding treaties can be written, then two unbiased countries can always reach an agreement over transfers that will avoid a war. Wars are avoided not due to the factors that Doyle, Russett and others have suggested (e.g., norms and affinities that democracies have for other democracies, various political checks and balances[3], among others), but due to a lack of political bias in the bargaining process. To the extent that a lack of political bias (or even a bias less than one due to a fear of losing office on the part of an executive)[4] is exhibited by democracies, our model then provides some new reasoning behind observations that two (mature) democracies tend not to go to war with each other. However, it is important to note that our model does predict that two *politically biased* democracies could still go to war with each other if they are each sufficiently biased. Thus, here mutual democracy is neither a necessary nor sufficient condition for peace.

[3]Although, one could consider such checks and balances as items which ensure a lack of political bias.

[4]See Downs and Rocke (1994) for a detailed discussion of the incentives of an executive to engage in war relative to the electorates incentives to retain the executive.

Second, in our model it is possible for two countries to go to war even though they both have complete information about the relative likelihood of winning, and despite the facts that they could bargain and make payments to avoid war and that war burns resources. This is related to the well-known "Hicks Paradox" from the bargaining literature which ponders the occurrence of strikes and failed bargaining in general contexts. Essentially, for bargaining to break down, one needs some sort of friction or failure in the process, and there are many that have been discussed. These include incomplete and asymmetric information, differences in beliefs, indivisibilities, and agency problems.[5] Our model operates from an agency perspective, where political bias reflects the differences between the agent (the leader or pivotal agent in the government) who makes key decisions in the bargaining process on behalf of the principal (the country). This provides an explanation which indicates why wars can happen even when countries might have accurate intelligence about each other's military capabilities, and even when they have the power to bargain and make transfers to avoid a war.[6]

Third, in our model there are a variety of scenarios in terms of which country might be the aggressor. It could be that both countries knowingly and willingly go to war in that neither would rather avoid it (see Blainey (1973)), or that a smaller country is so biased politically that it is willing to take on a larger country even though it faces expected losses overall, or it could be that a larger country wishes to take on smaller countries (or even colonize them) because of its overwhelming power. Seeing how this variety of configurations depends on the political bias and war technology helps provide a unifying view of seemingly very different scenarios for war. Moreover, political bias explains things like the *uneven contenders paradox* first discussed by Carl von Clausewitz (1832), which refers to cases in

[5] Explanations of wars based on miscalculations or errors due to lack of information or to different priors about relative power have been discussed by Blainey (1973) and Gartzke. (1999), among others. As argued by Fearon (1995, 1997), once we allow for bargaining and communication, these explanations are consistent if there are strategic incentives to hide (or not to reveal) information or problems with signalling. For work on indivisibilities in bargaining and the relation to war see Kirshner 2000. There are also variations on spiralling phenomena (Waltz (1959), Schelling (1960)) analyzed by Jervis (1976, 1978). There the game between two contenders who have to decide whether to engage or not in an arms race is represented as a stag-hunt game, in which each player prefers to arm only if the other does so. Baliga and Sjöström (2003) have shown that even if there is an infinitesimally small belief that the opponent is someone who would arm no matter what, a spiral of mutual distrust can arise and lead to an arms race with probability one (in the absence of communication).

[6] By transfers we do not refer to explicit monetary transfers only; we also refer to transfers of territory, control over seas, and even implicit transfers of wealth and control linked to the marriages between royal families across Europe up to the end of the 19th century.

which one small or weak country doesn't concede even though it expects losses from a war.

Finally, in addition to the literature already discussed, let us mention a few other related papers from the vast literature on war.

Our model clearly fits into a "realist" (a term due to von Clausewitz (1832)) framework, where war is based on practical cost/benefit calculations and with full knowledge of circumstances. Bueno de Mesquita (1981) is one of the central references an analyses of war based on cost/benefit calculations by countries. Our introduction of political bias, as a (very crude) model of the political process, allows us to study the bargaining between countries in a way that makes non-trivial predictions about the possibility and circumstances leading to war. And, as discussed above, our modeling of political bias allows us to do this without relying on poor information or incompatible beliefs among countries.

Bueno de Mesquita, Morrow, Siverson, and Smith (2003) analyze the important variation across countries in terms of inclusiveness of the so called "selectorate," and their perspective is the closest to ours in terms of our measure of political bias. Our model can be viewed as incorporating such ideas of different political systems into the basic structure of a cost/benefit model.

At the end of the paper, we examine potential alliances between countries. There it becomes clear that a very strong form of stability, where no group of countries could gain by reorganizing themselves into new alliances will generally not hold. This is related to issues of empty-cores in a variety of coalitional games with some sort of competition. In settings where core-stability fails, we might still be interested in whether weaker forms of stability can be satisfied, or one can appeal to other predictions about outcomes such as von Neumann-Morgenstern stable sets. We adopt the former approach. For an example of a model that adopts the latter approach, see Jordan [?] who studies pillage games. Those are coalitional games in which a coalition with more wealth than another can make the other surrender all or part of it's wealth at no cost. Pillage is clearly related to war, but differs in that it is costless and the outcome is certain (the stronger takes from the weaker).[7] In a pillage setting, bargaining, transfers, and political bias have no room to operate.

[7]See also Piccione and Rubinstein (2003), who examine distributions of resources across countries so that no country has any incentive to take from another, where stronger countries can take costlessly and at will from weaker countries.

2 A Materialistic Model of War

We first focus on a potential war between two countries in complete isolation. We denote the countries by i and j. We return to the case of more countries below.

Let w_i denote the total *wealth* of country i.

We model the technology of war in a simple way. If countries i and j go to war against each other, country i prevails with probability $p_i(w_i, w_j)$, which is nondecreasing in w_i and nonincreasing in w_j. When the wealth levels are clear, we let p_{ij} denote $p_i(w_i, w_j)$. The *probability that country j prevails* is $p_{ji} = 1 - p_{ij}$. This simple form ignores the possibility of a stalemate or any gradation of outcome, but still captures the essence of war necessary to understand the incentives to go to war.

Note that it is possible that $p_i(w_i, w_j) \neq 1/2$ when $w_i = w_j$. This allows, for instance, i to have some geographic, population, or technological advantage or disadvantage.

In terms of the consequences of a war, we model the costs and benefits as follows. Regardless of winning or losing, a war *costs* a country a fraction C of its wealth. If a country wins, then it *gains* a fraction G of the other country's wealth.[8] So, after a war against country j, country i's wealth is $w_i(1 - C - G)$ if it loses and $w_i(1 - C) + Gw_j$ if it wins.

When two countries meet, they each decide whether to go to war and if either decides to go to war then a war occurs. As part of the decision process they may be able to make transfers of resources or territory, or to make other concessions.

Let a_j denote the fraction of w_j controlled by the agent who is pivotal in the decisions of country j. The fraction of the spoils of war that the pivotal agent might control can differ from the fraction of the wealth that they hold, especially in non-democratic regimes or in situations where there might be other sorts of benefits from war (for instance, to a pivotal military leader). The fraction of the spoils of war obtained by the pivotal agent is a'_j. Thus, in the absence of any transfers the pivotal agent of a country j wishes to go to war if and only if

$$(1 - C)a_j w_j - (1 - p_{ji})Ga_j w_j + p_{ji}Ga'_j w_i > a_j w_j, \tag{1}$$

where the left hand side is the expected value of a war and the right hand side is the expected value of not going to war.

We can rewire this so that the expected gains are on the left hand side and the expected losses are on the right hand side:

$$p_{ji}Ga'_j w_i > [C + (1 - p_{ji})G]\, a_j w_j. \tag{2}$$

[8] We could also add fixed costs (independent of wealth), but that would add little to the analysis.

Political Bias

Let $B_j = \frac{a'_j}{a_j}$ denote the ratio of the percentage that the pivotal decision making agent stands to gain versus what he or she has at risk. We call this the *political bias* of country j.

Again, we interpret a country with high B_j as being "less democratic" (or "more dictatorial") than a country with a lower B_j, and we use the term *pure democracies* to refer to situations where $B_j = 1$. We realize that there may be totalitarian regimes for which $B_j = 1$ and democracies where $B_j > 1$. Thus, democracy is neither necessary nor sufficient for a political regime to be unbiased. We are thus using the term loosely, but use it nonetheless, since we are abstracting from all the other governance and institutional differences between democracies and non-democracies.

It is important to emphasize that although we model the relative gains and losses as being proportional to wealth, the critical aspect of political bias in our model is that there is a difference between the incentives of the pivotal decision maker and the country as a whole. This might, more generally, include things like potential power that a military leader or politician might gain from winning a war, which would bias them away from considering the pure costs and gains from war and can effectively be viewed as a distorted view of gains ($a'_j > a_j$). We also note that bias could similarly be less than 1. It could be, for instance, that a politician fears losing office due to a lost war, and this could manifest itself in having the politician overly weight the losses of a war. Our analysis still applies directly.

We can then rewrite 2 as:

$$B_j p_{ji} G w_i > \left[C + (1 - p_{ji})G\right] w_j. \tag{3}$$

This inequality, where the left hand side is the normalized expected gains (having divided by a_j) and the right hand side is the normalized expected costs, makes the role of the bias quite clear. If it is greater than 1 then it overweights potential gains, while if it is less than 1 then it underweights potential gains.

We note some intuitive comparative statics.

The "tendency" of j to want to go to war (as measured in the range of parameter values where j wants to go to war)

- is increasing in B_j and G, and decreasing in C.
- depends only on the ratio of C/G and not on the absolute levels of either C or G.
- depends only on B_j and not on the absolute levels of either a_j or a'_j.

The comparative statics in w_i and w_j are ambiguous, as wealths enter through p_{ji}, as well as directly. For instance as w_i increases, the potential spoils from war increase, but the probability of winning, p_{ji}, decrease. Which of these two effects dominates depends on the technology of war.

Given this dependence on the technology, for the purposes of illustration it is useful to carry several examples of winning probabilities throughout.

Example 1 ***Proportional Probability of Winning***

We say that the probability of winning is proportional (to relative wealths) if $p_{ji} = \frac{w_j}{w_j+w_i}$. In this case, (3) can be rewritten as

$$\frac{(B_j-1)Gw_i}{w_i+w_j} > C. \tag{4}$$

Remark 1 *Under a proportional probability of winning, a politically unbiased country ($B_j = 1$) never wishes to go to war. If $B_j > 1$, then the tendency for j to want to go to war is increasing in w_i and decreasing in w_j.*

Example 2 ***Fixed Probability of Winning***

We say that the probability of winning a war is fixed if $p_{ji} = \frac{1}{2}$, regardless of wealth levels. This is a more extreme case that captures situations in which wealth has less of an impact on the probability of winning a war.

In that case, (3) can be rewritten as

$$B_j\frac{w_i}{w_j} > 1 + \frac{2C}{G}. \tag{5}$$

Here an unbiased country (democracy) could want to go to war, but only if its wealth is low compared to the other country. In general, in this case a country's tendency to want to go to war is higher if they have relatively less wealth.

Example 3 ***Higher Wealth Wins***

We say that the higher wealth wins if $p_{ji} = 1$ when $w_j > w_i$, $p_{ji} = 0$ when $w_j < w_i$, and $p_{ji} = \frac{1}{2}$ when $w_j = w_i$. This is another extreme case that captures situations in which wealth is the critical determinant of the probability of winning a war.

In this case, a country j wishes to go to war (in the absence of transfers) whenever $w_j > w_i$ and not when $w_j < w_i$. The case when wealths are equal is as in the fixed case.

3 The Interplay between Political Bias and Transfers

We begin with the important benchmark where no transfers are possible.

3.1 War incentives in the absence of transfers

When two countries meet it could be that neither country wishes to go to war, just one country wishes to go to war, or both countries wish to go to war. If neither wishes it, then clearly there is no war, and transfers would be irrelevant. If both countries wish war, then there is a war and no transfers could possibly avoid it. The only situation where one country might be willing to make transfers that could induce the other country to avoid a war come when just one country has in interest in engaging in war. Let us first make some observations regarding the parameters that lead to the various possible scenarios, and then come back to focus on transfers.

PROPOSITION **1** No Transfers. *Consider any fixed w_i, w_j and p_{ij}.*

(I) If $B_i = B_j = 1$, then at most one country wishes to go to war regardless of the other parameters.

(II) Fixing any ratio $\frac{C}{G}$, if B_i and B_j are both sufficiently large, then both countries wish to go to war.

(III) Fixing any B_i and B_j, if $\frac{C}{G}$ is large enough, then neither country wishes to go to war.

All proofs appear in the appendix.

For fixed biases $B_i > 1$, $B_j > 1$, and a fixed ratio $\frac{C}{G}$, whether or not one or both countries wish to go to war depends on the technology p_{ij} and the wealth levels in ways that may not be purely monotone.

3.2 Transfers to avoid a war: the commitment case

We now focus on situations where in the absence of any transfers one country would like to go to war but the other would not.

When transfers are made from country i to country j, we assume that the decision maker in country j gets α'_j of the transfer, and the decision maker in country i loses α_i of the transfer. Thus, decision makers' biases towards transfers are the same as towards gains and losses from war. This is not critical to any of the results, as it is only important that a bias be present somewhere. We make this assumption to be consistent with gains and losses.[9]

The interesting case is to identifying when it is that transfers will *avoid* a war. That is, we would like to know when is it that:

- in the absence of transfers j wants to go to war with i,
- i prefers to pay $t_{ij} > 0$ to j rather than going to war, and
- j would prefer to have peace and the transfer t_{ij} to going to war.

It is important to note that when we say that transfers *avoid* a war, we are imposing the constraint that a war would have occurred in the absence of any transfers.[10]

We start with the case where countries can commit to peace conditional on the transfer t_{ij}. This is a situation where the countries can sign some (internationally) enforceable treaty so that they will not go to war conditional on the transfer. In the absence of such enforceability or commitment, it could be that i makes the transfer to j and then j invades anyway. We deal with the case of no commitment in the next section.

PROPOSITION **2** *Consider a case where j wishes to go to war (in the absence of any transfers) while i does not. Holding all else equal, the range of relative costs to gains $\frac{C}{G}$ where a transfer can be made that will avoid a war is larger when*

- *B_i is smaller,*
- *p_{ji} is larger, and*
- *w_i/w_j is larger (holding p_{ji} fixed).*[11]

The proposition is fairly intuitive. The effect of reducing B_i makes i less likely to want to go to war, and to gain less from a war, and hence willing to make larger transfers to avoid

[9]For instance, our results still hold qualitatively (with some differences in the exact equations), if we assume that decision makers evaluate all transfers (in or out) at a rate of α_j (or all at α'_j).

[10]There are other possibilities that arise as well, that we ignore. For instance, if two countries both have high biases, their leaders might benefit from making transfers in both directions - as each is able to more easily keep a larger share of the transfers they receive. Essentially, they loot each other's countries. While this is plausible within the model, it is not something that we investigate seriously.

[11]If we do not hold p_{ji} fixed, then things are ambiguous, as larger relative wealth makes i better able to pay, but also better able to win.

it. Increasing p_{ji} or w_i/w_j (holding p_{ji} fixed) have the same effect, and also increase the range where j would like to go to war in the absence of any transfers. So, for instance, a technological change that exogenously favors one country in a war (an increase in p_{ji}) makes transfers more likely to avoid war, especially when the challenger is more powerful, relatively more politically biased, and/or poorer (in relative terms).

It is also important to note that it need not be the wealthier country that is the challenger. For example, a poor but politically biased country can extract transfers.

The proof of the proposition appears in the appendix, where we show that the following condition:

$$p_{ji}(1 + B_j \frac{w_i}{w_j}) - 1 > \frac{C}{G} > \frac{(1 - p_{ji})(B_i B_j - 1)}{(1 + B_j \frac{w_i}{w_j})}, \tag{6}$$

characterizes the situations where transfers avoid a war. The left hand side corresponds to country j wanting to go to war in the absence of any transfers, while the right hand side corresponds to the willingness of i to make a transfer that would induce j to no longer want to go to war. The effect of the political bias of the potential attacking country j, B_j, is ambiguous. It makes country j more aggressive, but also leads i to be willing to make larger transfers. Which effect dominates depends on a variety of factors.

In the case of two unbiased countries (loosely "democracies"), we obtain the following result.

Proposition **3** [Democratic Peace] *Two unbiased countries ($B_i = B_j = 1$) will never go to war if they can make transfers to each other and the receiver of a transfer can commit not to go to war after receiving the transfer.*

The result is easy to understand. War imposes costs, and so when bargaining is unbiased, the total pie from avoiding a war is larger than the total pie from going to war. Thus transfers avoid a war. The formal proof comes from noting that the right hand side of (6) becomes 0 when $B_i = B_j = 1$, so one democracy is always willing to buy the other off. So either war is avoided because neither wanted it in the first place, or because one country is willing to pay the other off (recalling that at most one democracy ever wants to go to war).

Proposition 3 identifies a new explanation for the observation that democracies rarely go to war. Most of the explanations of this fact in the literature concern internal checks and balances within a democracy, or the cultural norms and relative affinities that one democracy has for another. Here we point out that two democracies never go to war because they can always find some transfer (perhaps bargaining under the threat of war) that makes it irrational to go to war.

It is important to note that the presence of political bias means that this conclusion is only true for two politically unbiased countries (e.g., democracies) meeting each other and is not true if either country is politically biased. Also, this further makes the point that it is not *democracy* that is the key determinant of peace, but *political bias*. Thus, the prediction of this model would be a "politically unbiased peace" result, rather than a liberal peace or democratic peace result.

Let us also say a few words about commitment. Commitment could come from international organizations who could enforce peace agreements (e.g., the U.N.); or also from longer-term reputation effects. If a country is to face a number of countries over time, then by abiding by its promises it will earn future transfers, while otherwise it will end up fighting a series of wars. Clearly, if transfers are preferable to war in each case, then the country would prefer to have a series of transfers over a series of wars. With an infinite horizon, and a high enough discount factor, the country would prefer to abide by its agreements, rather than to go to war and lose all possibilities of transfers in the future.

We can also return to some of our benchmark cases, to get a better feeling for when transfers will avoid a war.

In the benchmark case where $p_{ji} = \frac{1}{2}$ regardless of wealth levels (Example 2), (6) implies that there exists a range of values of $\frac{C}{G}$ such that transfers help avoid war if and only if

$$B_i < B_j \left(\frac{w_i}{w_j} \right)^2 .$$

So in this case it is very clear that transfers help the most when B_i is small, B_j is large, and/or $\frac{w_i}{w_j}$ is large.

In the other extreme case where the higher wealth wins (Example 3), and when j has a relative wealth advantage, (6) simplifies to

$$B_j \frac{w_i}{w_j} > \frac{C}{G} > 0.$$

Here, war is again "more avoidable" with larger bias B_j and larger w_i/w_j (which leads to larger relative transfers), but now B_i is irrelevant as i is sure to lose.

3.3 The no-commitment case

Let us now suppose that a country cannot commit to avoid a war if it receives transfers. As discussed above, commitment can relate to a number of factors: the presence or lack of international organizations which (have the incentives to) enforce agreements, the patience of the challenger, the likelihood of meeting other countries in the future from which the challenger might gain from having maintained a reputation for abiding by its agreements, etc. So, a lack of commitment power might be due to a variety of reasons.

In the no commitment case, to avoid a war not only does a transfer have to be such that the potential aggressor is willing to forego the current opportunity for a war, but it also needs to be such that after the transfer has been made a war is no longer in the aggressor's interest. Transfers do three things:

- They make the target poorer and less appealing,
- They make the challenger richer and have more to lose,
- They increase the probability that the challenger will win.

Here, we can see that there are countervailing effects. If the probability is not affected too much by a transfer, then it is possible that transfers can still help avoid a war, as transfers can change the wealths of the two countries so as to make it no longer in one country's interest to invade the other.

There are a number of things that we observe about the no commitment case.

First, we can show that the situations where war is avoided due to transfers in the case of no commitment are a strict subset of those when there is commitment. In both cases, the transfers that the potential target country is willing to make are the same. The only differences are from the challenger's perspective. The difference between the two cases is that in the commitment case, a potential aggressor compares the value of no war (their wealth plus any transfers) to what they would gain from a war in the absence of any transfers; while in the no commitment case a potential aggressor compares the value of no war (again, their wealth plus any transfers) to what they would gain from a war after transfers have been made. The value of a war to an aggressor after they have received transfers is strictly higher than the value of a war before any transfers, as the probability of winning is weakly higher and in the case where transfers have already been made, the aggressor gets to keep a portion of those transfers regardless of whether they win or lose, while in the other case they only get that wealth if they win.

Next, the no commitment case has the following interesting feature. There are some transfers $t_{ij} > 0$ which would not avoid a war, but yet there are lower transfers, t'_{ij} where $t_{ij} > t'_{ij} > 0$, which would avoid a war. Thus, it is possible that too high a transfer will lead to war while a lower transfer will avoid a war. This can be true in a case where the changes in transfers lead to substantial enough differences in the probability that the challenger wins the war. Larger transfers can lead the country making the transfers to be more vulnerable in terms of being more likely to lose a war, and thus higher transfers can end up leading to a war that lower transfers might have averted. This is illustrated in the following example.

First, we note that a transfer t_{ij} from country i to j makes it so that j does not want to go to war after having received the transfer in the case of no commitment if[12]

$$p'_{ji}B_jG(w_i - t_{ij}) \leq (C + (1 - p'_{ji})G)(w_j + B_jt_{ij}), \tag{7}$$

where $p'_{ji} = p_{ji}(w_j + t_{ij}, w_i - t_{ij})$.

Example 4 *Smaller Transfers Avoid a War*

Let $B_i = 1$, $B_j = 4$, $w_i = w_j = 100$, $C = \frac{1}{10}$ and $G = \frac{1}{10}$. Have $p_{ij}(w, w) = \frac{1}{2}$.

Note that in this case (3) is satisfied, so initially j wishes to go to war with i.

We estimate (see (14) in the appendix) that i would be willing to make a maximal transfer of $\bar{t}_{ij} = 10$ to avoid war. In the case of commitment, we can then check that this would avoid war (see (12) in the appendix, which is then satisfied).

Let us set $p_{ji}(110, 90) = 3/4$. Thus, if a transfer of $\bar{t}_{ij} = 1/10$ is made, then j would still wish to go to war after the transfer as (7) is not satisfied, and so the transfer would not avoid a war.

However, consider a smaller transfer of $t = 8$. Suppose that $p_{ji}(108, 92) = 1/2 + \varepsilon$. For small enough ε, (7) is satisfied and so this smaller t avoids a war!

This means that in general we can no longer adopt the method used to prove results in the last section, where we deduce the maximal possible transfer that a country is willing to make to avoid a war and see if that avoids a war. Without specifying the p function, one cannot determine which transfers will avoid a war.

What we do know is that:

- transfers can still avoid a war,
- the set of parameter values where transfers avoid a war is a subset of the commitment case,
- the set of parameters for which war is avoided grows as $\frac{C}{G}$ increases;
- The set of parameters for which war is avoided grows as B_i decreases.

[12]This is simply a rewriting of (3) where i's wealth is $w_i - t_{ij}$, and where j's wealth from the biased decision maker's perspective is $w_j + B_jt_{ij}$ but enters into the war technology as $w_j + t_{ij}$.

The fact that smaller B_i helps avoid war is due to the fact that this results in an increase in the set of transfers that i is willing to make. The effect of $\frac{C}{G}$ increasing is clear, as it helps make both countries wish to avoid a war. The effects of B_j and w_i, w_j are ambiguous, as again the technology of war (p_{ji}) matters.

There are cases where we can deduce things about the ability of transfers to avoid war. The key to Example 4 is that there is a large change in probability due to a larger transfer, so there is a sort of convexity of the probability of winning function. If the probability function is not affected at all (e.g., Example 2) or are proportional, as in Example 1, then we can examine the maximal transfers as the relevant benchmark. The possibilities of avoiding war are still reduced relative to the commitment case, but the comparative statics are then similar.

In particular, the democratic peace result still holds for the case of a proportional p function.

Proposition 4 [Democratic Peace Without Commitment] *If the probability of winning is proportional to relative wealths, then two unbiased countries ($B_i = B_j = 1$) will never go to war if they can make transfers to each other (even without commitment).*

This is clearly not true for all probability of winning functions. What is subtle, is that while it is true for proportional probabilities, it is not true for probability functions that are either less responsive to relative changes in wealths or more responsive to relative changes in wealths. This is seen as follows. First, consider a case where p is constant and equal to $\frac{1}{2}$. In this case, a smaller country will wish to go to war with a larger one, as it has relatively little at risk and much to gain. The transfer that a larger country is willing to make is relative to its expected losses from a war. After having received a transfer the small country still have relatively more to gain from a war than it expects to lose.[13] At the other extreme, where the higher wealth wins for sure, it is the larger country that is the aggressor. The smaller country is willing to pay something to avoid a war, but not its entire wealth. After having received a transfer, the larger country can still want to go to war provided there is enough wealth left in the smaller country to justify the cost of war, as the larger country will win for sure.[14]

[13]For a numerical example, suppose that $w_j = 1$ and $w_i = 10$, and that $C = .1$ and $G = .2$. The maximal transfer that i is willing to make is 1.9. If such transfers were made, the smaller country would have wealth 2.9 and the larger 12.1. The smaller country would still wish to go to war.

[14]For a numerical example, suppose that $w_i = 10$ and $w_j = 15$, and $C = .1$ and $G = .3$. Here the maximal transfer that i is willing to make is 3. After such a transfer, the wealths are $w_i = 7$ and $w_j = 18$. A war

4 Stability and Alliances

Let us now consider settings where there are many countries.

4.1 Bilateral Stability

Consider some set of countries $\{1, \ldots, n\}$, their respective wealths $(w_1, \ldots, w_n)$ and biases $(B_1, \ldots, B_n)$, a technology of war that is specified for each pair ij, p_{ij}, and relative costs and gains C and G. We say that such a configuration of countries is *bilaterally stable* if there would be no war between any two of the countries if they met, even in the absence of any transfers.

Bilateral stability is characterized by having (3) fail to hold for each pair of countries. We can see directly from (3) that if the relative costs of war (C/G) are high enough, then we will have bilateral stability. Beyond that, we need to know more about the probability of winning function and how that compares to the biases. The following proposition outlines one case where bilateral stability holds.

Proposition **5** *[Democratic Stability] If all countries are politically unbiased and the probability of winning a war is proportional to wealth, then the countries are bilaterally stable.*

This proposition follows directly from Remark 1.

We can also say something about how biased countries can be while still having bilateral stability. The following proposition works for more general war technologies, but starting from a point where all countries have equal wealths.

Proposition **6** *If all countries have equal wealth and p_{ij} is symmetric, then the configuration is bilaterally stable if and only if $B_j \leq 1 + 2\frac{C}{G}$.*

This follows from (3), setting $p_{ji} = 1/2$ and $w_i = w_j$.

Beyond these propositions, bilateral stability is can be directly characterized by bilateral checks of (3).

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then costs the larger country 1.8, but yields 2.1 in gains (as it wins for sure), and so the larger country will still go to war.

4.2 Coalitional Stability

Another question we address when examining many countries concerns alliances and coalitional stability.

Alliances work as follows. When a set K of countries form an alliance, the decision maker from country i still has $a_i w_i$ in terms of wealth at risk (and thus loses $(C+G)a_i w_i$ if a war is lost), and shares $a_i' \frac{w_i}{\sum_{j \in K} w_j}$ of the spoils of war or transfers. Alliances decisions are by unanimous. Each country's decision maker must be willing to undertake an offensive war in order for it to happen. The default is not to attack unless the coalition is unanimous about doing so, which reflects the idea that the coalition might dissolve otherwise. The maximum total transfer that an alliance might make in order to avoid a war is the maximum sum of transfers across its members, such that each would be willing to contribute their part in order to avoid a war.

The technology of war is presumed to be given by a function p which only depends on the total wealths of the warring alliances.

With this structure of alliances in mind, there are a number of different things we can consider. We can consider whether there exist configurations of alliances such that the alliances are bilaterally stable (no alliance wishes to attack any other alliance). We can also consider whether there exist configurations of alliances that are immune to deviations by any subset of countries (who might quit their current alliance and join with others to form a new alliance). We can consider weaker deviations, asking whether there are is any single country who wishes to quit its current alliance and would be unanimously accepted into some other alliance. Finally, we can differentiate between offensive and defensive alliances, and allow for various bilateral alliances, so that A might be allied with B, and B with C, but not A with C, etc.

Let us begin with a couple of examples that make clear some of the issues that arise.

The first example illustrates why there are interesting alliance issues that arise and why we might want to move beyond simply studying bilateral stability.

Example **5**

Consider three equal sized countries with $w_1 = w_2 = w_3$ and $B_1 = B_2 = B_3$. If the corresponding B_i's are not too high, this could be bilaterally stable. However, this is not necessarily coalitionally stable. Two countries might have an incentive to form an alliance and exclude the third country. This could strengthen them so that they might either wish to go to war regardless of any transfers, and both benefit in expected terms from doing so.

For example, in the case of unbiased countries and higher wealth winning, two countries that band together expect to gain from going to war with the third country.

The next example illustrates that it could be that countries form alliances not for offensive purposes (as above), but instead for defensive purposes.

EXAMPLE **6**

Consider three countries where one's wealth is twice the size of each of the others. By forming an alliance, for some choices of B_i's, the two smaller countries avoid being attacked or having to pay a transfer. For example, if it is the larger wealth that wins, then separately the countries are sure to lose a war, while allied they have an even chance of winning.

Clearly, from the examples above, it is possible that there will not exist any configuration of countries and alliances that are bilaterally stable (so that no alliance would attack another in the absence of any transfers), and also no set of countries would like to reform or dissolve an alliance.

We can still explore a few things. First, is it possible to have alliance configurations that are bilaterally stable and such that no country would want to quit its existing alliance either to be alone or to join another alliance. Let us call such an alliance configuration *individually stable*.

PROPOSITION **7** *Consider any parameters C and G, and any continuous p such that $p(w, W) << w/W$ when w/W approaches 0.*[15] *If there exist at least two countries with biases close enough to 1, biases of countries are bounded above, and there are enough countries such that each country's wealth is sufficiently small relative to the total world wealth, then there exists a division of countries into two alliances that is individually stable.*

The proof is straightforward and so we simply outline it. Separate the two countries with lowest biases. Then around each, form an alliance so that the total wealths in the two alliances are as close to each other as possible. Given the continuity of p, the probability of either alliance winning a war approaches $\frac{1}{2}$. With a small enough bias, the least biased country in each alliance will prefer not to go to war. Consider any country switching alliances. Their wealth, if small enough relative to total wealth, will make too small a change in probabilities of outcomes to change the incentives of the alliances.[16] The only remaining

[15]More precisely, consider p such that $p(w, W)W/w \to 0$ as $w \to 0$, for any fixed $W > 0$.

[16]The only possible exception is if the least biased country leaves and the remaining countries are strongly biased, but then that can only lead to the biased country alliance wanting to attach the other alliance, which does not benefit the country that switched.

possibility is that a country could gain from autarchy. However, in that case, providing countries are small enough relative to total wealth, even with maximal bias, (3) fails to for the departing country as its probability of winning is so small relative to the maximal potential gains that it will not have an incentive to go to war with one of the (large) alliances.

5 Discussion

As should be clear from some of the above analysis, this basic model of political bias opens the door for much future research. Let us comment on a few of the more obvious areas for further exploration.

It is clear that one can begin to examine the predictions of the model empirically. One can do this by a structural fit of the model, estimating wealths, costs, gains, and war technology (p) directly from the data, and either imputing the biases or estimating them based on other political variables.

One can also develop variations on the model which endogenize various parameters that until now we take to be exogenous. Let us mention a few ideas in this direction.

- The model could be coupled with a growth model so that wealths change over time. As wealths change, so will incentives to go to war (and incentives to capture territory to help with growth), and one could track how the economics of growth interacts with the incentives for international conflict.

- The political bias of a country could be seen a strategic variable that is chosen by a country, or by its leaders, either through elections or other means. What is the optimal political bias for a country?

- One could enrich the technology of war to allow for investments in arms, so that the probability of winning a war depended on military spending and not simply on wealth directly.

- We could enrich the model to endogenize the timing and choice of confrontation, so that we do not only examine stability or the choices of two countries once faced with war, but also more completely model how it is that two countries start to consider a war and how this might depend on the more general environment.

The above extensions begin to suggest that more dynamic analysis could be interesting. Let us close with a few observations on this topic. The most basic and important aspect that dynamics introduces is that as countries get richer, their incentives change. As a country j has won past wars, three things happen. First, its wealth increases, and so the w_{ij}'s it faces will decrease. This in turn has a second effect which is that p_{ji} increases. Third, as more wealth is acquired, the pivotal agent's percentage share of the wealth increases and so B_j decreases. To see this, note that before a war the agent's share is a_j. After the war, if the country wins, the agent's share is

$$\frac{a_j(1-C)w_j + a_j' G w_i}{(1-C)w_j + G w_i}. \tag{8}$$

If $a_j' > a_j$, then this new share is larger than a_j. Thus, the new B_j is a_j' over this new share, and so as a country keeps winning wars, B_j will decrease.

Let us examine the implications of these changes over time. We know from (3) that a country will want to go to war (without consideration of transfers) if

$$p_{ji} > \frac{1+\frac{C}{G}}{1+B_j \frac{w_i}{w_j}}. \tag{9}$$

As we see from above, if a country has become wealthier through the winning of past wars, then the right hand side of this expression will have increased as both B_j and w_{ij} will have decreased (if we are holding the wealth of a given opponent constant). On the other hand, the left hand side will also go up as p_{ji} increases.

While we cannot say what the short-term effects of this are, we can say that a country will not wish to go on going to war for too long. This follows from noting that p_{ji} is bounded above by 1, while w_{ij} can go to 0. As a country becomes much wealthier than other countries, it no longer desires to go to war as the right hand side of (9) will converge to $1 + \frac{C}{G}$, while the left hand side is bounded above by 1. Essentially, even if the country is sure to win the war, it does not wish to go to war because the costs outweigh the spoils of war against a much smaller country.[17]

Interestingly, depending on the technology of war, as one country becomes much wealthier it may no longer wish to go to war, but it may become an attractive target for smaller countries, since they may have much to gain and little to lose. Whether or not this is the case depends on how fast p_{ji} increases in w_j. In the long run (i.e., after each pair of countries has faced the temptation of war or gone to war sufficiently many times), a war between countries of very different wealths (winners and losers of past wars respectively) will be possible only if the poorer country wants it. Finding situations where it is the stronger

[17] It might be more reasonable to presume that the costs of going to war against a much smaller country are small. However, if the costs of going to war have any lower bound, then the conclusion will still hold.

countries that would be the aggressors, would require some of the other extensions mentioned above, such as changing technologies, growth, or changes in political bias.

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6 Appendix: Proofs

Proof of Proposition 1: We know that (3) is the condition to satisfy for j to be willing to go to war against i in the absence of transfers. Similarly, country i wishes to go to war with country j if and only if

$$1 - p_{ji} > \frac{1 + \frac{C}{G}}{1 + B_i w_{ji}}. \tag{10}$$

Part (III) follows directly from (3) and (10), as both right hand sides are increasing in $\frac{C}{G}$.

Next, note that from (3) and (10) it follows that both countries want to go to war if and only if

$$1 - \frac{1 + \frac{C}{G}}{1 + B_i w_{ji}} > p_{ji} > \frac{1 + \frac{C}{G}}{1 + B_j w_{ij}}. \tag{11}$$

It is clear that if $B_i = B_j = 1$ (the case of two pure democracies) then inequalities (11) require that

$$1 - \frac{1 + \frac{C}{G}}{1 + w_{ji}} > \frac{1 + \frac{C}{G}}{1 + w_{ij}}.$$

To see this is impossible, rewrite the above inequality as

$$1 + w_{ij} - \frac{1 + \frac{C}{G}}{w_{ji}} > 1 + \frac{C}{G}.$$

This simplifies to

$$-w_{ij}\frac{C}{G} > \frac{C}{G},$$

which is clearly impossible. This proves (I).

The proof of (II) derives from the following observation: the left hand side of (11) converges to 1 as B_i gets large and the right hand side of (11) converges to 0 as B_j gets large. ∎

Proof of Proposition 2: As j wishes to go to war but i does not, (3) holds but (10) does not. The condition that needs to be satisfied for country j to no longer wish to go to war against i if offers $t_{ij} > 0$ is

$$(1 - C - G)a_j w_j + p_{ji} G(a_j w_j + a_j' w_i) \leq a_j w_j + a_j' t_{ij}.$$

This simplifies to

$$p_{ji} G(w_j + B_j w_i) \leq (C + G) w_j + B_j t_{ij} \tag{12}$$

Similarly, the condition for i to be willing to make a transfer $t_{ij} > 0$ to avoid a war is

$$(1 - p_{ji}) G(w_i + B_i w_j) \leq (C + G) w_i - t_{ij} \tag{13}$$

Note that we assume that the pivotal agent in country j gets the same proportion (a'_j) of t_{ij} as they would if it were a spoil of war, and the pivotal agent in country i pays the same proportion (a_i) of t_{ij} as it risks of its wealth in a war.

Let $\bar{t}_{ij}$ be the transfer that makes country i (who wishes to avoid war) indifferent between going to war and paying such a transfer, i.e., the transfer that makes (13) hold as equality. In other words, $\bar{t}_{ij} > 0$ is the maximum transfer that i is willing to make in order to avoid the war. Then

$$\bar{t}_{ij} = (C+G)w_i - (1-p_{ji})G(w_i + B_i w_j) \tag{14}$$

Substituting (14) in (12), a transfer can be made so that country j no longer wishes to go to war if

$$p_{ji}G(w_j + B_j w_i) \leq (C+G)w_j + B_j(C+G)w_i - B_j(1-p_{ji})G(w_i + B_i w_j).$$

This can be rewritten as

$$\frac{C}{G} \geq \frac{(1-p_{ji})(B_iB_j - 1)}{1 + B_j w_{ij}} \tag{15}$$

When we combine this with (3) we obtain the following characterization of when transfers avoid a war:

$$p_{ji}(1 + B_j w_{ij}) - 1 > \frac{C}{G} > \frac{(1-p_{ji})(B_iB_j - 1)}{(1 + B_j w_{ij})}. \tag{16}$$

The comparative statics in the proposition are then clear. ∎

Proof of Proposition 3: Given proposition 1(I), we know that when two pure democracies meet, the situation without transfers is either (w1) or (w2). If it is (w1) we are done. If it is (w2), then assume without loss of generality that j is the one who wants to go to war and i is the one who does not. We have established above that in this case the availability of transfers eliminates the incentive of j to go to war if (15) holds. Thus, the result follows, noting that the RHS of (15) is 0 with two unbiased countries. ∎

Proof of Proposition 4: In the case of proportional winning probabilities, we know that an unbiased country will not wish to go to war with or without transfers. ∎