# War Finance and Coercive Bargaining

**Branislav L. Slantchev***
*Department of Political Science, University of California – San Diego*

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**Abstract.** Many, if not most, wars are funded by debt, either domestic or from foreign lenders. Historically, losers repudiate their wartime debts, and even winners are often tempted into partial defaults, restructuring, or inflation. Since governments are normally committed to repaying their debt in peace, peace settlements become inefficient and can affect crisis bargaining and the probability of settling disputes through negotiations. I analyze a complete-information model in which players can determine the distribution of power through their military allocations during a crisis. These decisions influence the terms of any negotiated settlement they obtain and the war they fight if they fail to come to terms. When players can finance some of their spending through debt they are committed to repaying in peace or victory, then they can use this for strategic coercion. I show that sometimes players would incur debt that would trigger war under complete information even with an infinitely divisible good under dispute. This new explanation for war is not due to commitment problems or informational asymmetries but is driven by the inefficiency of peace imposed by the need to repay the debt.

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*E-mail: slantchev@ucsd.edu. I thank Matthew Kearney for research assistance. I gratefully acknowledge financial support from the National Science Foundation (Grant SES-0850435).

If money is the sinews of military power, then credit is the tendon of Achilles. Wars are generally funded by a combination of taxes and loans. Always unpopular with the citizens, taxes have traditionally fallen far short of supplying the revenue necessary to meet the extraordinary demands of war. It is on borrowed money that the heftiest burden of paying for wartime expenses is carried. Unfortunately, our models of crisis bargaining assume that military power is exogenous, and thus the issue of war finance does not arise. Even theories that do study the effect of resource allocation choices on crisis or war behavior do not tackle the issue of war finance in general, and certainly not the peculiarities of borrowing in particular. This article is a first step toward a theory of crisis bargaining and war that does so.

Financing military preparation and fighting with loans introduces new dynamics in crisis bargaining and war. First, the government cannot commit to repaying the debt, especially if it loses the war. Second, it must attract lenders by offering terms that would compensate them for the risk of default. As the military situation worsens, the government's ability to procure funds to continue the war would deteriorate as well. Furthermore, the need to honor these financial obligations may force the government to demand much larger concessions from the opponent, concessions that might prove to be too onerous compared to what the opponent expects to secure by fighting. Thus, governments that cannot mobilize sufficient resources from their existing tax base might need to borrow so that they can improve their military capabilities and avoid an unfavorable outcome at the negotiating table with a stronger opponent. If they are not sufficiently efficient at converting their resources into military capabilities, however, they might need to borrow so much that their opponent would not grant them the concession they need to repay their debt. This unhappy situation might result in an inevitable war even under complete information, providing us with a new rationalist explanation of war that relies neither on commitment problems or uncertainty. As I show in this article, contrary to the usual assumption that peace is an efficient way to distribute resources, debt financiering makes peace inefficient from the perspective of the borrower. Under certain conditions this can destroy all chance of peaceful dispute settlement: there simply might exist no deal that both sides prefer to war given that one of them has borrowed money for his military preparations.

## 1 Borrowing for War and Debt Repudiation

The following historical excursus is primarily intended to motivate the assumptions of the model by substantiating four major claims. First, borrowing is an important, and in some instances crucial, way to increase the country's ability to wage war. Second, despite strong interest in repaying the debt, governments can find themselves unable to meet their obligations, and might be forced to repudiate some or all of the debt. Third, debt repudiation is much more likely if a country loses a war. Fourth, lenders are generally quite aware of these risks and would take them into account when deciding what rates to demand from the government.

There are several options for a government that needs to defray its military expenses: it can use accumulated reserves (or sell government property), it can tax, it can plunder or exploit the conquered territory, it can rely on foreign subsidies, it can manipulate the money supply (by printing money or debasing the currency), or it can borrow, either from its own population (in which case the practice could range from entirely voluntary to effective "conscription of wealth") or from foreign lenders. Of these, taxation and borrowing tend to be by far the most prevalent, and with time the latter has become the major source of war finance.

There have been very few governments that could go to war on an existing "war chest," like Frederick the Great did when he invaded Silesia in 1740 using the 8-million thaler hoard of cash that his predecessor had patiently accumulated over his reign (Blanning, 1996, 7–8). Even when such reserves exist, they are rapidly depleted, always much faster than the governments imagine they would. When Athens went to war with Sparta, Pericles supposed that its sizeable reserve would enable the city to wage defensive war for many years, and indeed it appears that Athens funded the war mainly from capital until 428 B.C., when the unexpected Mytilene revolt forced the government to introduce an income tax and a new levy on the allies (Blamire, 2001).

As we shall see, even in wealthy states, the heavy burden of war quickly overwhelms the resources that can be conscripted from its tax base, and this has been true even for those, like Britain, that have had the advantage of a developed and relatively efficient system of tax collection. Attempts to increase taxation during war can be especially dangerous because they might provoke resistance that, given the army's engagement at the front, could boil over into open rebellion, as Louis XIV repeatedly discovered.

When taxes are not enough, war can be financed by plundering conquered territories or, more intelligently, by exacting some form of forced "contributions", usually from the enemies, but, in a pinch, from one's own citizens and allies too. During the especially ruinous Thirty Years War (1618–48), some generals nearly perfected the system to the point that it came to resemble regular tax collection. The most famous is Wallenstein but even he relied far more on his personal credit rather than extortion to fund his forces. The French also resorted to this system when they marched and subsisted on the locals in Germany, whether under Louis XIV or Napoleon. However, this funding method was politically explosive (because it made the conquered people even more hostile), vulnerable to corruption (because of loss of agency control over the military collecting the revenue), notoriously unreliable (because despoiled towns often could not provide even a fraction of the funds expected), and subversive of military strategy (because often effort had to be directed to securing areas for contributions rather than toward victory).[1]

Conventionally, the Nazis have become the epitome of rapacious plunder and exploitation of slave labor in the conquered territories. Some have even asserted that the expropriation of wealth from the German Jews and, more profitably, the extraction of resources from the population of occupied Europe enabled the regime to sustain the war effort with little cost to its own citizens (Aly, 2005). The statistics, however, tell a different story: even this regime could not but saddle the Germans with an extremely heavy burden. Between 1940 and 1943, the share of national income (which includes foreign sources) dedicated to war increased from 25% to 76%, making Germany the heaviest spender along with the Soviet

[1] Wilson (2009, 399) discusses Wallenstein's methods. See, *inter alia,* Lynn (1999, 56–58) on the armies of Louis XIV and Blanning (1996, 152–168) on how the French Revolutionary Armies rampaging through Europe showcased most of these problems. Esdaile (2007) provides a comprehensive account of Napoleon's depredations and Bordo and White (1991) argue that the regime's lack of credibility forced it to rely on taxation, with the money of conquered nations going to support the French armies.

Union. But contrary to the image of the German citizens not contributing to this, over the same period the share of national income represented by the domestic finance of the war grew from 24% to 60%, making German society by far the most mobilized. In other words, despite the fabled spoils of conquest, it was the ordinary Germans that were bearing the brunt of war funding, most of it in form of loans to the government.[2]

Most governments do not have the opportunity to engage in plunder on so vast a scale as the Nazis, and even they could not make it alleviate the domestic costs of war. Forced exploitation of foreigners is not the only remedy available internationally, however. One could look for other governments that might be interested in helping one's war effort without asking for payment except for consideration in the postwar peace. The English, as usual when it comes to matters financial, furnish the ready example. Britain was the paymaster of all sorts of combinations against the French state, whether it be ruled by Bourbons, Bonapartes, or some unstable revolutionary regime. The English paid Frederick the Great £200,000 in 1757, and from the following year, £670,000 per annum to support Prussia's participation in the Seven Years War. The subsidies drastically increased toward the end of the century but especially during the Napoleonic Wars. By 1816, Great Britain had disbursed £50 million to all members of the numerous coalitions against the French Emperor, with £30 million of these spent in the last four years of war (i.e., after Napoleon's invasion of Russia).[3]

For their part, the French certainly reciprocated: Louis XIV by advancing funds to The Pretender (which did not work) and Louis XVI by supplying the Americans in their own Revolution (which did). In the American Revolution in particular, the French loans amounted to \$6.4 million, and the subsidies to \$2 million, so the grant was substantial.[4] The French also perpetuated the conflict that became the Thirty Years War by providing fresh subsidies for the Swedes for their operations against the Hapsburgs in Germany, not to mention contracting with Bernhard von Weimar to continue his.[5]

Thus, foreign subsidies could be an important source of financial support during war, but they do come with strings attached. Even if the recipient need not repay them, he still has to pursue policies consistent with the wishes of the effective holder of the purse. The political influence this admitted was resented because it was occasionally used to rein in the recipient. The more dependent he was on the subsidy, the more vulnerable to such pressure. The subsidies were unreliable because support could be terminated at any time due to domestic strife (as it happened to the French during the Thirty Years War) or domestic political fighting in the donor country (as it happened to the English during the Seven Years War). Disbursements were often late and short of promised amounts. Finally, and most obviously, it is not easy to get involved in a war that would interest a wealthy paymaster.

Nearly all governments manipulate the money supply during war, either by printing

[2] See Table 3 in Harrison (1988). If one looks only at taxes, as Aly (2005) does, then one would conclude that the Germans paid at most 30% of the costs while the war was going on. This (inexplicably) ignores the other forms of domestic war finance. This critique is due to Tooze (2005), see Tooze (2008) for a comprehensive analysis of the Nazi war-time economy.

[3] H. (1931).**also cites to seven years war and napoleon**

[4] Bemis (1957, 91—93) gives the numbers and notes that the Spanish contributed another \$0.4 million in subsidies and \$0.3 million in loans.

[5] Asch (1997, 160,165–66). The Swedes had relied on debt financing too, which explains their obstinacy at Osnabrück, where they demanded indemnities that would enable them to meet their obligations.

money or debasing the coinage. As the worth of money declines, prices go up. Drastic debasement of the sort that Ferdinand, the Hapsburg Holy Roman Emperor, resorted to in the initial stages of the Thirty Years War, could easily provoke hyperinflation, which in that case lasted for about five years and caused serious economic dislocations. Inflation might be beneficial because it reduces the costs of the government's debt but the citizens also become suspicious of the future value of money, so they become more reluctant to use it. Ferdinand, for one, did not really try to repeat that policy (Asch, 1997, 156–57). The Sun King's perpetual warfare also inspired quite a bit of financial creativity and there was not a single shenanigan that his ministers did not try. He taxed, he plundered, he borrowed, and he debased the currency, mostly by issuing interest-bearing notes without enough coins to support their redemption, by one count five times after Colbert died.[6] Perhaps the most notorious example is when the frenzied printing of *assignats* during the French Revolution eventually caused the floor of the printing house literally to collapse under their weight in a fitting metaphor of the recklessness of the government's inflationary policy.[7]

The final strategy that governments have recourse to when it comes to funding their military spending is that of borrowing. Since numbers are perhaps more convincing that a handful of cites, I offer some examples of the magnitude of war-related debt major powers have incurred, and its weight relative to taxation. I also note the problems of repudiation and risks that lenders face.

Consider the experience in World War I. The German war-related government expenditure averaged 24,426 million marks per annum between 1914 and 1918. This constituted 76% of the average total public expenditure over that period (32.1 billion marks per annum), and since the average deficit was 25.9 billion marks, it follows that most of the war-time extraordinary spending was funded by debt. In other words, Germany was fighting on borrowed money.[8] The staggering amounts the government was committing to repaying after the war naturally increased the demands for indemnities Germany expected to impose on its defeated opponents. The German Financial Secretary Helfferich used the model of the French indemnities after the Franco-Prussian War (which the French repaid by getting themselves into debt) to plan for a "massive indemnity [that] would be the panacea to Germany's war debt," and idea to which his successor returned to as late as 1917 (Gross, 2009, 246-47). Any such scheme was obviously predicated on victory, and as the prospects receded, so did the ability of the government to raise more money. Even patriotic exhortations in the press subtly linked repayment to victory, or as one newspaper put it, the government promised that "the Reich will honor its obligations, that it will promptly pay any interest coming *when it is victorious in the war*."[9]

The Germans at least started from a relatively advantageous economic situation. Their main ally, the Austro-Hungarian Empire, was burdened with heavy debt from the outset. Over the same four years of war (and despite inflationary money-printing), the Empire sank

[6] He was not an innovator: debasements had been common in France (White, 1999; Velde, 2005). Bonney (1995) estimates that in 1707, the certificates traded at 60% to 70% of their nominal value, reflecting the loss of confidence.

[7] Blanning (1996, 124).

[8] Calculations based on Table 2.14 in Broadberry and Harrison (2005, 60).

[9] Cited in Gross (2009, 248), emphasis added. The war-loan subscriptions collapsed very quickly once the army was beaten on the Western Front, and the hope of victory evaporated.

further into debt: Austria's annual debt averaged 85% of the GDP, and although this was falling toward the end of the war, the actual amount owed increased from 18 billion crowns in 1914 to 82 billion in 1918.[10]

Like Austro-Hungary, France started the war with a substantial debt burden (65% of GDP), and then ran up a breath-taking tab during the war. War-time spending quickly outpaced income, with the budget deficit standing at 12% of GDP in 1914 (none in the year prior to the war), and then hovering around 40% until the war's end. Even the introduction of an income tax, an unpopular and resisted move, did not make a dent in this trend. The government inflated some of the debt away but was mostly saved by its ability to float loans at low rates, a privilege it enjoyed because of the high credibility of the commitment to repay their debts, which it had demonstrated in the wake of the disaster in 1871.[11] Like the Germans, the French expected to pay the bulk of their obligations either through new debt or through extractions from defeated opponents. When Paris proved incapable of raising a fresh loan in London after the war, the effort the repay the debt owed to Britain resulted in stricter demands for reparations from Germany, and the 1923 occupation of the Ruhr to exact them (Turner, 1998, 88-94).

Britain was a major source of financial support for the Allies until the American entry swamped everything. But even while lending to others, the government was fighting on borrowed money itself. The deficit shot up from 14% of GDP in 1914 to nearly 48% in 1917, and was wrestled down to 35% at the war's end. Despite some inflationary expansion of the money base, most of the deficit was funded by borrowing. The national debt rose from 26% of GDP in 1914 to 128% in 1919.[12] Such a massive increase in indebtedness was nothing new for the kingdom. During the Nine Years War (1689–97), the government spent an average of £5.46 million per annum, and incurred a total new debt of £16.70 million; during the War of the Spanish Succession (1702–13), it spend £7.06 million per annum, and accumulated a debt of £22.10 million. During the War of the Austrian Succession (1739–48), it spent £8.78 million per annum, and ended up with a £29.20 million debt. The spending and indebtedness only accelerated thereafter. The government spent £18.04 million per annum during the Seven Years War (1756–63), and shouldered a total new debt of £58 million at the war's conclusion. The American Revolution (1775–84) proved even costlier, with annual spending averaging £20.27 million, but the debt sky-rocketing to £115.60 million by the time the empire had to part with the colonies.[13] Whereas it is often claimed that Britain's impressive improvement in the administrative apparatus for tax collection after 1688 had enabled the country to draw on its resources more effectively, the government did not finance its wars with heavier taxation during wartime. Instead, it relied mostly on borrowing, with the ready availability of loans being explicable by the credible commitment to servicing the debt with peacetime taxation after the war (Bordo and White, 1991).

While generally credible, this commitment was not absolute because it was recognized

[10]Calculations based on Table 3.20 in Broadberry and Harrison (2005, 102). The figures for Hungary are average annual debt of 69% of the GDP, also falling toward the end of the war. Hungary owed 11 billion crowns in 1914 and 36 billion in 1918.

[11]Broadberry and Harrison (2005, 185-6). Calculations based on Table 6.8.

[12]Tables 7.7 and 7.9 in Broadberry and Harrison (2005, 216).

[13]Calculations based on Table 2.1 in Brewer (1990).

the debt repayment could be conditional on regime survival. The rates for bonds issued by the Bank of England dropped precipitously as advances by the armies of Louis XIV in support of The Pretender James III increased the likelihood of his victory and thereby the risk of repudiation, which "appeared likely in light of the fact that much of the national debt had accumulated since the Revolution, and had primarily been used to prevent a Stuart restoration and to fight France"(Wells and Wills, 2000, 428).

Having to pay a higher rate might have inconvenienced the British government, but it was a serious problem for the Sun King. Since taxation quickly fell short of funding the enormous armies that Louis XIV was fielding (and further increases often provoked distracting rebellions), the king had to finance his ballooning expenses primarily through borrowing (Lynn, 1999, 24-5). In this, his own past behavior was his worst enemy. The king had forcibly reduced the debt from 600 million francs to 250 million in 1643, the first year of his reign. The continued participation in the Thirty Years War increased it again, and by 1661 the interest payments alone stood at about 30 million francs per year. Mazarin and Colbert both repudiated some of the debt, and more than once. These defaults made it difficult to raise fresh loans for the Dutch Wars (1672–78), and the government had to agree to pay higher rates. Just as spending stabilized, new wars plunged the country into debt again. The War of the League of Augsburg (1688–97) increased indebtedness to 200 million francs, a 90% jump from the pre-war level, and the interest rates were increasing with the difficulties in the war. The costliest of them all, the War of the Spanish Succession, saw Louis XIV unable to secure adequate funds either through taxation or by borrowing, and the Sun King resorted to the printing press. When the war ended, the national debt stood at the unmanageable 3 billion francs, and although the government initially repaid some of its obligations at unilaterally reduced rates, in 1715 it repudiated much of it down to 1.7 billion. The repeated repudiations curtailed access to credit and wrought economic chaos (Hamilton, 1947).

France developed debt servicing problems again during the Seven Years War, when the government was forced to suspend repayment of the capital in 1759, and the exigencies of war eventually led to a partial bankruptcy after the war, in 1770. The Revolutionary regime did not do better: after recklessly printing money to finance its wars, it first reduced interest payments by two-thirds, then canceled the debts of émigrés and convicts, and finally refused to pay even the reduced amount in full.[14] After the Napoleonic Wars, the French government was more careful in managing its debt, and established a reputation that enabled it to borrow vast sums for wars (the Crimean War was almost entirely financed by the 2.2 billion francs of new debt), and even for failed foreign adventures like Napoleon III's involvement in Mexico (which added another 400 million francs to the national debt burden). When the Franco-Prussian War ended the 5 billion franc indemnity owed to the Germans was added to the 16.7 billion existing obligations, which the French valiantly struggled to keep under control.

The defeated state's ability to service its debt can be purposefully hampered by the victor. Even a European recluse like the Ottoman Empire found it necessary to take out sizeable loans (£8 million organized in London) to finance its war effort during the Crimean War

[14] Bordo and White (1991, 309–10). White (1999, Table 4) provides a history of defaults during and following wars from the last War of Religion (1585–98) through the American Revolution.

in 1854 (Eldem, 2005). The Empire's indebtedness to the West increased at an alarming rate until the burden of debt servicing caused a suspension of payments on the eve of the Russo-Turkish War of 1878. The victorious Russians imposed an indemnity which gave them priority access to funds. In 1881 they successfully used this to veto the resumption of payments on the Porte's public debts to European bondholders (Milgrim, 1978, 522).

As even these selective episodes show, governments do not default on their debts willy-nilly. The usual pattern is that of genuine attempts to honor their obligations, and then repudiating as little as possible (often by restructuring the debt on forced concessionary terms) when faced with dire financial exigencies. Since the bulk of government spending went to military preparations and waging war, and because wars were so common, this meant that most of them lurched from one financial crisis to the next. Every government was acutely aware of the importance of its credit for its fate in the next war that was surely just around the corner. In fact, restoring one's finances disarrayed by the last war was an intense competition to see who will do so first and thus be better prepared for the next one. Banking practices almost exclusively looked at prior behavior of sovereign borrowers to determine how credible the promise to repay was, so governments had strong interest in repaying their debts. Thus, repudiation would tend to occur only in catastrophic circumstances, and these usually came from being defeated in war because this tended to entail additional losses of territory and payment of indemnities, if not changes in regime.[15]

Debts grow during war not just because governments continue to borrow but because they do not, as a rule, amortize the principal. Generally, once fighting begins, governments focus on paying only the interest charges on their debts, with the implicit promise to pay in full after the war. It is curious to note that some scholars have asserted that running out of money would never cause a country to stop fighting because it can always requisition and borrow. But coercive requisitioning is liable to undermine the war effort and the inability to pay even the ongoing interest would certainly wreck the credit standing. Thus, paying for the war cannot actually be entirely "postponed until after its conclusion."[16] However, the mere fact that the bulk of the money owed is supposed to be repaid only after the fighting is over exposes the investment to the non-negligible risk of (perhaps involuntary) default.

As we have seen in the British case, potential lenders are quite aware of the risks that defeat exposes their investments to, and this will be reflected in their willingness to subscribe to loans offered by the threatened government. Debt repudiation is especially common when defeat results in a change of regime or removes a territory from the control of the polity. For example, when the Bolsheviks came to power in Russia and withdrew from the World War I, they repudiated all debts, internal and external to the tune of £3.4 billion, of the predecessor Empire (Moore and Kaluzny, 2005).

In this, the Bolsheviks were following well-established precedent which can be dated to postwar treaties at least as far back as the Peace of Campo Formio of 1797 (Cahn, 1950). In contrast to the French in 1871, the Prussians and the Austrians specifically repudiated

[15]Edling (2007, 301) notes the banking practices in Amsterdam, and Brewer (1990, 173) discusses the competition over fiscal reconstruction.

[16]The argument that war finance is not a crucial determinant of military success is cited by Strachan (2004, 2–3), who also disagrees with it but for different reasons. Seligman and Haig (1917) note that in the U.S., the question of war finance has traditionally been about "whether taxes could be made sufficiently high to meet merely the interest charges on the money borrowed without any allowance even for amortization."

the Danish king's debt contracted for the 1864 Schleswig-Holstein War.[17] Prussia then refused to honor the debt incurred by the Danish Army in the Duchies after the annexation in 1866.[18] The Germans also repudiated the Polish debts in 1940, and consistently did so for every conquered territory thereafter.

It is not just fervent anticapitalists, grasping European monarchs, or rapacious Nazis that engaged in this practice. The American government partially defaulted on its obligations incurred during the Revolutionary War. During the Civil War, the Confederacy funded its military spending primarily by borrowing (54% as opposed to 14% by the Union which relied mostly on taxes). The financial situation got so desperate that in the latter phases of the war, "debt service began to rival war expenditures" (Burdekin, 1993). The subsequent repudiation of these obligations is enshrined in the Fourteenth Amendment of the U.S. Constitution, which held that all Confederate debt was "illegal and void" while upholding the validity of the public debt incurred by the Union. The morality of repudiation of odious debt was expressed well in the American position on Cuban loans contracted after 1890: "the creditors knew that the revenues were pledged for the continuous effort to put down a people struggling for freedom, and that they took the obvious chances of their investment on so precarious a security." It is not difficult to see why a government that takes over territory from a defeated rival might be loath to honor the debts the rival had incurred in fighting that very takeover.[19]

The mostly voluntaristic nature of debt, the commitment to repay it unless forced not to by circumstance, the risks of repudiation upon defeat, and the ability to finance military effort through loans are special features of war-finance that relies on borrowing, and they user a peculiar dynamic into crisis bargaining, war fighting, and peace negotiations. Although this is the subject of theoretical study in this article, it would be profitable to enumerate some of the concerns that will arise.

The debate about the desirability of public debt between Alexander Hamilton and Thomas Jefferson is illustrative. It was self-evident to Hamilton that the state's ability to expand its mobilizable resources beyond the constraints of the tax base would be crucial to any war. The nation's credit "is so immense a power in the affairs of war that a nation without credit would be in great danger of falling a victim in the first war with a power possessing a vigorous and flourishing credit."[20] He chastised some for being "ignorant enough" to think that war can be paid for by taxation alone, and pointed that even "powerful and opulent" nations like England, France, and the United Provinces are "deeply immersed in debt".[21] These were "plain and undeniable truths", that "loans in times of public danger, especially from

[17]The debt was seen as contracted as if "on behalf" of the duchies, and as such the obligation after their loss devolved from the King of Denmark to the successor government of the Duchies, which repudiated it.

[18]The Prussian King eventually granted an indemnity in 1875 without admitting legal responsibility, and there only because of the precedent set by French claims in Alsace-Lorraine.

[19]Cited in Cahn (1950, 482). He also notes that the notion of odious debt includes loans contracted *before* the war for military purposes as well as those contracted *during* the war (477). Because it is difficult to ascertain how the funds were spent, in practice the date the debt was incurred is "the only determining factor of a 'war debt'" (481). Backer (2007) notes that the origins of the modern doctrine of odious debt can be traced to the American refusal to recognize the debt Spain had incurred to keep its Cuban colony.

[20]The cite is from *Defence of the Funding System,* and is quoted by Edling (2007, 295).

[21]Lodge (1904), Vol. 1, The Continentalist IV. Included in *The Online Library of Liberty.* Accessed from http://oll.libertyfund.org/title/1378/64156/1591126 on 2010-01-19.

foreign war, are found an indispensable resource, even to the wealthiest of them. And that in a country, which, like this, is possessed of little active wealth, or in other words, little monied capital, the necessity for that resource, must, in such emergencies, be proportionably urgent."[22] Jefferson did not deny that borrowing would improve the country's ability to wage war. In fact, this was precisely he disapproved of it. His position was that public debt hid the real costs of war from the people in a way that taxes did not, and therefore increased their belligerency. He wished for "an additional article [in the Constitution] taking from the Federal Government the power of borrowing. [...] I know that to pay all proper expenses within the year would, in case of war, be hard on us. But not so hard as ten wars instead of one. For wars would be reduced in that proportion."[23] He cursed the "spirit of war and indebtment, which, since the modern theory of the perpetuation of debt, has drenched the earth with blood, and crushed its inhabitants under burdens ever accumulating" and noted how an inability to borrow would have placed the English "under the happy disability of waging eternal war."[24]

We thus have, between the two, the essence of the argument that will be proved in this article: if we stipulate that borrowing can expand a state's ability to mobilize military resources and thereby improve its prospects in war, then a country that would be disadvantage when relying solely on its tax base would have strong incentives to borrow even though it is entirely possible that debt would increase the probability of war. Of course, because the model I present involves forward-looking rational players, the result does not rely on hidden costs of fighting or belligerency but on the state's commitment to repay the debt only in peace or victory while repudiating it in defeat. Furthermore, as we shall see, the real problem that debt creates for peace is in the inefficiency it induces into the negotiated settlements that effectively require one side to agree to concessions that would pay for the debts of the other in order to induce it to eschew fighting.

The problem with peace settlements can be illustrated directly by the problems that surfaced during the last years of the Thirty Years War. The cash-strapped belligerents had enormous difficulties in paying their soldiers and pay arrears had become a major form of deficit finance. Even though the governments would write off the debts owed to soldiers killed or missing in action, the total obligation was simply too huge for that to keep them solvent. Wilson (2009, 400) describes the effect succinctly: "The balance owed to the others exceeded any realistic hope of settlement. It became impossible to demobilize armies, because regiments refused to disband until they were paid." These rampaging mobile "cities" of soldiers proved a great irritant and destabilizer to the rulers for many years, and in no small degree prompted the shift away from contract armies.

Somewhat indirectly, one of Hamilton's arguments could also be parlayed into service of this one. Among the numerous benefits of public debt that he foresaw was that it would tie the bondholders to the fate of the existing regime (the republic was young at the time and its survival by no means assured). Since it was the wealthier that tended to have the capital to subscribe to government loans, this would ensure their support, presumably because the

[22] Syrett and Cooke (1979), Vol. 6, pp. 67–72. Included in *The Founders' Constitution,* Vol. 2, Article 1, Section 8, Clause 2, Document 5. Accessed from http://press-pubs.uchicago.edu/founders/documents/a1_8_2s5.html on 2010-01-19.

[23] Letter to John Taylor, November 26, 1798 (Lipscomb, 1904, Vol. 10:64–5).

[24] Letter to John W. Eppes, June 24, 1813 (Lipscomb, 1904, Vol. 13:272).

extinction of the debtor government would also mean the loss of their investment. This is why Hamilton argued for a permanent public debt. The same logic would, of course, apply in much less salutary polities: the bondholders would have similar incentives to support odious governments for much the same reasons.[25] More to the point, it might make war termination all that much harder, especially if the terms the government would have to agree to would not permit it to repay its debts.[26] Thus, the Jeffersonian view would be vindicated. Naturally, the U.S. government's behavior followed Hamilton's advice. Even Albert Gallatin, whose aversion to public debt was notorious, could not see any way out of relying on loans as the primary method of paying for wartime expenses. When the War of 1812 finally came, the U.S. paid for it mostly by borrowing: out of approximately $70 million in war expenditure, the government funded $64 million, or almost 92%, from the proceeds of loans.[27]

## 2 War Finance and the Rationalist Explanations for War

The modern rationalist explanation of war between two unitary actors disputing the distribution of some benefit begins with the premise that, unlike negotiations, war is a costly way to settle such a dispute. If there is one thing that fighting is guaranteed to do, it is to consume resources, wreak destruction, and kill people. This is the one constant feature of war irrespective of who emerges victorious from the conflict. It also means that the size of the benefit after the war must necessarily be smaller than the size before the war. Because crisis negotiations are over the larger benefit, it is always possible to locate agreements that neither side would be willing to fight to overturn. In other words, since war is less efficient than peace, there always exist mutually acceptable deals that satisfy each side's minimal war expectations. To explain war, then, is to explain why actors fail to coordinate on one of these agreements that avoids war.[28]

The answers to this question can be broadly categorized as informational and commitment problems. Most of the work thus far has focused on the informational issue: when actors have private information about their capabilities or their preferences, their expectations about war depend on factors the opponent cannot verify. Because it always profits an actor to obtain larger concessions, it would often be the case that he would benefit were his opponent to believe that such a concession must be made.[29] Because the actor has

[25]The current thinking about such odious debts actually strengthens these incentives because it would seem to ensure the repudiation of these debts upon regime dissolution.

[26]Part of the explanation for Hapsburg Spain's ability to sustain its long struggle with France during the Thirty Years War despite Castile's great inferiority in resources lies in the readiness of the Cortes to keep the monarchy afloat, mostly because its members were creditors to the Crown and had a vested interest in its victory despite setbacks and partial defaults, like the 1627 bankruptcy which wiped out the Genovese banking houses Asch (1997, 168–9).

[27]See the table in Adams (1917, 69). Gallatin's concern was mostly about the rate the government would have to pay to attract private capital (Balinky, 1959).

[28]The view that war is a kind of bargaining process can be traced back to von Clausewitz's (1989) distinction between absolute and real war. Schelling (1960) argued that most conflict situations are about bargaining, and Blainey (1988) insisted that war should be explained by reference to reasons actors would not want to concede terms that would satisfy the war expectations of the opponent. Fearon (1995) provides the canonical formal treatment. See Powell (2002) for a recent survey of the formal work.

[29]Slantchev (2010) shows that this is not generally the case: there might be circumstances where an actor

incentives to exaggerate his war expectations and because the opponent cannot verify the accuracy of these claims, it might be impossible to convince the opponent to concede terms that would satisfy the actor even if he is sincere in his claims. War breaks out and fighting persists until players' expectations converge sufficiently to make agreement possible.[30]

Such an explanation has to confront at least three issues. As Powell (2006) has pointed out, the mechanism cannot adequately account for many historical cases, and it would have trouble accounting for periods of protracted fighting.[31] The third problem is that when war occurs under this mechanism, it is never the case that neither actor would agree to some terms that are known to satisfy the opponent. In fact, as I show in the discussion section, it might be the case that actors fight even though there exist mutually acceptable peace deals, and they are common knowledge. This strains the mechanism and at any rate cannot account for *wars of choice*, that is, wars where both actors would rather fight than accept the terms the opponent is willing to offer.

One way to remedy some of the deficiencies of the informational approach is to analyze the situation under complete information. We know of several mechanisms for this case: the inability to commit credibly not to use the advantage a player would acquire after a large and rapid shift of power (Powell, 2004b);[32] the inability to commit credibly to fighting if an opponent violates the peace terms for short-term advantage (Leventoğlu and Slantchev, 2007); the expectations to coordinate on disadvantageous peace terms (Slantchev, 2003a); the incentives to escalate probabilistically in order to deter repeated challenges (Langlois and Langlois, 2005); and the high costs of maintaining peace by mutual deterrence (Powell, 1993). Although these can overcome the first two shortcomings of the informational mechanism, they cannot really explain wars of choice.

The most important shortcoming, however, is that almost none of our existing explanations take into account how actors prepare and maintain the military resources that they would use in crisis bargaining or war. Even dynamics models that suppose changes in power over time assume that the shifts are exogenous. In contrast, economic models that do investigate resource allocation typically do not include war and even if they do, they do not study the choice to abandon peace for fighting. What is needed, then, is a model of crisis bargaining and war where military power is endogenous and where actors are aware that their allocation decisions would affect their ability to negotiate disputes without resort to costly violence.[33]

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might prefer to conceal his strength and forego some of the advantage that would accrue were the crisis to end peacefully.

[30]Powell (1999, Ch. 3) lays out the standard model of the risk-return trade-off (although see Leventoğlu and Tarar (2008) for an analysis that questions the robustness of the mechanism.) Wagner (2000) argued forcefully that war should not end the bargaining encounter, and the subsequent work on incomplete information and war has generally followed his line. Slantchev (2003b) lays out the principle of convergence, which also occurs in related models (Powell, 2004a; Smith and Stam, 2004; Filson and Werner, 2004).

[31]This is because simultaneous fighting and bargaining should generally lead to belief convergence relatively quickly. Fearon (2007) shows why intrawar bargaining might be more difficult than the standard models imply. Langlois and Langlois (2009) show that depending on what one assumes about the bargaining protocol it is possible that no intrawar bargaining would occur and actors would engage in mutual attrition.

[32]As Powell (2006) points out, many other explanations, such as preventive war, first-strike advantages, and concessions that undermine one side's military advantage (Fearon, 1995), involve this basic mechanism.

[33]Powell (1993) studies a deterrence model where power is endogenous but there is no bargaining and no uncertainty. Slantchev (2005) studies a signaling model under asymmetric information but without bargain-

As a first step in studying the effect of debt financing of military allocations on crisis bargaining and the probability of war, I offer a model that builds on the existing crisis bargaining models and extends them in the simplest possible way consistent with the four features of the phenomenon I identified in the previous section. For reason explained above, I assume complete information, and to maintain comparability with the traditional puzzle of war, I assume a conflict over an infinitely divisible good. Since I am not particularly interested in the precise division that would prevail in peace, I assume that if there exist negotiated settlements that both players prefer to fighting, then they would coordinate on one of them (and for simplicity, I take it to be the Nash bargaining solution). The extension is in the endogenous determination of power before the crisis. Players can choose how many of their existing resources to mobilize for military purposes, and they differ in their ability to do so (one can think of this as their administrative capacity). In keeping with the importance of debt financing, one of the players can expand his resource base by borrowing money. Consistent with the historical observations above, I assume that the player is committed to repaying the debt if the crisis ends peacefully or if he wins the war, and that he will repudiate the debt if he loses the war. Initially I consider interest-free loans but in an extension I study what happens when the player has to attract lenders by offering interest rates that take into account the risk of default and compete with an alternative return on investments.

## 3 The Model

The provide crisp intuition for the fundamental result, it will be best to start with a simple model in which only one player can borrow to fund his mobilization. Two actors must divide a benefit of size 1 and status quo distribution $(y, 1-y)$, where $y \in [0, 1]$ is player 1's share. Player 1 decides how much, if any, debt to incur by choosing $d \geq 0$. The two players then simultaneously decide how many forces to mobilize, $m_i \geq 0$, up to their budget constraints. Player 1's marginal cost of mobilization is $\theta > 0$ and player 2's marginal cost is 1. Thus, $m_1(d) \leq (y + d)/\theta$ and $m_2(d) \leq 1 - y$. The forces mobilized become immediately available and determine the distribution of power summarized by the probability with which player 1 would prevail if war should occur:

$$p(d) = \frac{m_1(d)}{m_1(d) + m_2(d)},$$

if $m_1(d) + m_2(d) > 0$ and $p(d) = 1/2$ otherwise.[34]

ing. Slantchev (2010) investigates the effect of war-fighting allocation decisions on crisis bargaining under uncertainty but does not look at behavior before the crisis. None of these models considers the mode of financing even at a rudimentary level. The sole model of war finance is by Grossman and Han (1993) but it is decision-theoretic: there is no opponent, no bargaining, and no choice for war or peace.

[34]This is the usual specification and the discontinuity at $(0, 0)$ could be a serious problem with best responses. For instance, if player 1 picks $m_1 = 0$ and player 2 wishes to maximize her probability of winning at lowest possible allocation for herself, then she would have no best response: any $m_2 > 0$, no matter how small, guarantees victory. We could avoid this technical problem by defining $\varepsilon > 0$ and arbitrarily small, and requiring that if $m_i = 0$, then $p = 1/2$ for any $m_j < \varepsilon$ and defined as usual otherwise. Now if player 1 allocates nothing, player 2 does have a (unique) best response: $m_2 = \varepsilon$ because this yields victory while anything less yields only $1/2$ chance of it. In our specification, however, military allocations are unrelated to consumption, only to the budget constraint. This means that if $m_1 = 0$, then player 2 is indifferent how she maximizes her probability of winning: every $m_2 > 0$ is a best response.

After their mobilizations, players bargain over the division of the benefit. Player 1 is committed to repaying the debt if the interaction ends peacefully or if he wins the war should one occur. Defeat results in repudiation of the pre-war debt. For now, assume no interest on the debt. If players agree on a distribution $(x, 1-x)$ with $x \in [0, 1]$ being player 1's share, then player 1's payoff is $x - d$ and player 2's payoff is $1 - x$. If they fail to reach an agreement, war occurs. War is a winner-take-all costly lottery: it destroys a fraction of resources such that only $\pi < 1$ go to the victory (and nothing to the loser). Thus, player 1's expected war payoff is $W_1(d) = p(d)(\pi - d)$, and player 2's expected war payoff is $W_2(d) = (1 - p(d))\pi$. War is inefficient: $W_1(d) + W_2(d) = \pi - p(d)d < 1$.

I am interested in conditions sufficient for war to occur regardless of how players negotiate. To this end, I will leave the bargaining protocol unspecified. I assume that if there exist settlements that neither player would fight to overturn, then players would be able to reach an agreement on something in that range. More specifically, I assume that if the bargaining range (to be defined precisely below) exists, players would split the surplus using the Nash bargaining solution. In any equilibrium, player 1 would not fight to overturn any deal such that $x - d \geq W_1(d)$, and player 2 would not fight to overturn any deal such that $1 - x \geq W_2(d)$. The bargaining range is the set of deals $(x, 1 - x)$ such that $x \in [W_1(d) + d, 1 - W_2(d)]$. Mutually acceptable peaceful bargains would exist only when this set exists; that is, only when player 2's maximum concession is large enough to satisfy player 1's minimum demand: $1 - W_2(d) \geq W_1(d) + d$. When the set exists, the Nash bargaining solution would allocate it in equal shares to the players. That is, once each player obtains the equivalent to his war payoff, they divide the remainder equally:

$$x^*(d) = \frac{W_1(d) + d + 1 - W_2(d)}{2}.$$

The peace payoffs, therefore, are $P_1(d) = x^*(d) - d$ and $P_2(d) = 1 - x^*(d)$. Peace is inefficient for any positive debt: $P_1(d) + P_2(d) = 1 - d < 1$. Since the existence of the bargaining range is necessary for peace, its non-existence is a sufficient condition for war. The bargaining range will not exist when:

$$d > 1 - [W_1(d) + W_2(d)] \equiv S(d). \tag{W}$$

In other words, peace is not possible when the debt exceeds the surplus, $S(d)$, that remains after players obtain the terms they could guarantee by fighting. The logic is straightforward. Since each player can guarantee his war payoff, any negotiated deal must satisfy these minimal demands. Thus, the only "wiggle" room for bargaining is the surplus that remains once these minimal demands are satisfied. Condition (W) states that war must occur when giving player 1 the entire surplus would not be enough to enable him to pay off his debt. We can rewrite (W) as $(1 - p(d))d > 1 - \pi$, which is easy to interpret. The left-hand side is the benefit of repudiating the debt (which occurs with the probability of defeat), and the right-hand side is the total cost of war. Thus, condition (W) also states that if the benefit of repudiating the debt exceeds the costs of war, then no mutually acceptable bargains will be possible.

It is important to realize that the definition of $x^*(d)$ is such that if peace is possible, both players prefer it to war. This is because the bargaining range is defined in terms of deals which are acceptable to player 1 given that he would have to repay the debt if negotiations succeed, and to player 2 given her war payoff. Any deal in that bargaining range yields better payoffs compared to war. This implies that when the bargaining range exists, no player would ever fight, so the non-existence is also a necessary condition for war. In other words, condition (W) is both necessary and sufficient for the interaction to end in violence.

# 4 Analysis

## 4.1 The Military Allocations

For any given $d \geq 0$, the game after the military allocations can only have two possible outcomes: war and peace with a negotiated settlement. The sufficient condition for war in (W) can be satisfied only if $d + \pi > 1$. The converse of this necessary condition of war gives us a sufficient condition for peace: if $d + \pi \leq 1$, the continuation game must end with negotiations. Let $\overline{m}_1(d) = (y + d)/\theta$ and $\overline{m}_2 = 1 - y$ denote the maximum allocations for the players.

LEMMA 1. *In any subgame perfect equilibrium, $d \in [0, \pi)$.*

*Proof.* Since $d = 0$ implies that $d + \pi \leq 1$ is satisfied, any subgame perfect equilibrium with zero debt must end in negotiations, so player 1's expected payoff will be $P_1(0) = x^*(0)$. In fact, if $d = 0$ in SPE, the equilibrium is unique: players mobilize at maximum capacity. To see this, observe that $x^*(d)$ is strictly increasing in $p$, which itself is strictly increasing in $m_1$. Player 1's optimal strategy must therefore pick the highest possible allocation, $\overline{m}_1(0)$. Player 2's negotiation payoff, $1 - x^*(0)$, is strictly decreasing in $p$, which itself is strictly decreasing in $m_2$. Therefore, her optimal strategy must pick the highest possible allocation, $\overline{m}_2$. Thus, player 1's equilibrium payoff is:

$$P_1(0) = p(\overline{m}_1(0), \overline{m}_2)\pi + \frac{1 - \pi}{2} > 0.$$

Thus, for any $d > 0$ to be sustainable in SPE, it must be the case that player 1 obtains $P_1(d) \geq P_1(0)$. This puts an upper bound on the debt that can be incurred in any peaceful equilibrium. The best deal player 1 can obtain peacefully is $\overline{x} = (1 + \pi)/2$, which is the bargain that would result if player 1 were to win the war with certainty. If $d > 0$ is to be sustained in peace, it must be that $\overline{x} - d \geq P_1(0)$, or $d \leq (1 - p(\overline{m}_1(0), \overline{m}_2))\pi$. Since $p(\overline{m}_1(0), \overline{m}_2) \in (0, 1)$, this condition cannot be satisfied for any $d \geq \pi$, which means that no such value can be sustainable in a peaceful SPE. To see that $d \geq \pi$ cannot be sustained in a war SPE as well, note that player 1's payoff in such an SPE would be $p(d)(\pi - d) \leq 0 < P_1(0)$. Therefore, in any SPE with $d > 0$, it must be that $d < \pi$. □

The following result shows that the optimal mobilization choices are equivalent to maximizing the war payoffs, and are at the maximum permitted by the resource constraints.

LEMMA 2. *In equilibrium, players mobilize at the unconditional maxima, $\overline{m}_1(d) = (y + d)/\theta$ and $\overline{m}_2 = 1 - y$.*

*Proof.* By Lemma 1, we only need to consider some $d \in [0, \pi)$, in which case the peace and war payoffs are strictly increasing in the player's own military allocation:

$$\frac{\partial W_1}{\partial m_1} = (\pi - d)\frac{\partial p}{\partial m_1} > 0 \qquad \frac{\partial W_2}{\partial m_2} = -\pi \frac{\partial p}{\partial m_2} > 0$$
$$\frac{\partial P_1}{\partial m_1} = \left(\pi - \frac{d}{2}\right)\frac{\partial p}{\partial m_1} > 0 \qquad \frac{\partial P_2}{\partial m_2} = -\left(\pi - \frac{d}{2}\right)\frac{\partial p}{\partial m_2} > 0.$$

Observe further that the surplus is strictly increasing in player 1's allocation but strictly decreasing in player 2's:

$$\frac{\partial S}{\partial m_1} = d\frac{\partial p}{\partial m_1} > 0 \quad \text{and} \quad \frac{\partial S}{\partial m_2} = d\frac{\partial p}{\partial m_2} < 0.$$

Consider first player 1's allocation. Since $\lim_{m_1 \to 0} S(d) = 1 - \pi$, we can distinguish two cases. If $d \leq 1 - \pi$, then (W) can never be satisfied regardless of player 1's military allocation. In this case, the outcome must be peace, and, as we have seen, player 1 would maximize $P_1(d)$ by choosing $\overline{m}_1(d)$, as claimed. If, on the other hand, $d > 1 - \pi$, then very small allocations would result in (W) being satisfied, in which case war will be the outcome, and player 1 would want to maximize his allocation. If (W) is satisfied even at $\overline{m}_1(d)$, then war cannot be avoided, and $\overline{m}_1(d)$ is the optimal allocation. If, on the other hand, (W) fails at $\overline{m}_1(d)$, then there exists $\hat{m}_1$ such that $d = \hat{S}(d)$, or $\hat{W}_1(d) + d = 1 - \hat{W}_2(d)$. But this means that:

$$\hat{P}_1(d) = \frac{\hat{W}_1(d) - d + 1 - \hat{W}_2(d)}{2} = \hat{W}_1(d),$$

so player 1 is indifferent between peace and war at $\hat{m}_1$. Since $S(d)$ is increasing in $m_1$, it follows that peace will be the outcome for all $m_1 \geq \hat{m}_1$, but in that case, $P(d) > W_1(d)$, so player 1 will maximize his peace payoff, which he does by choosing $\overline{m}_1(d)$, as claimed.

Consider now player 2's allocation. Since $\lim_{m_2 \to 0} S(d) = 1 - \pi + d$, it follows that (W) must fail for such low allocations. We can therefore distinguish two cases, depending on whether (W) can be satisfied at $\overline{m}_2$ or not. If it fails even at $\overline{m}_2$, then peace will be the outcome regardless of player 2's allocation, and she will maximize her payoff by choosing $\overline{m}_2$, as claimed. If, however, (W) is satisfied at $\overline{m}_2$, then there must exist some $\hat{m}_2$ such that $d = \hat{S}(d)$, or $\hat{W}_1(d) + d = 1 - \hat{W}_2(d)$. But this means that:

$$\hat{P}_2(d) = \frac{1 + \hat{W}_2(d) - \left(\hat{W}_1(d) + d\right)}{2} = \hat{W}_2(d),$$

so she must be indifferent between war and peace at $\hat{m}_2$. Since $S(d)$ is decreasing in $m_2$, it follows that war must be the outcome for all $m_2 > \hat{m}_2$, but since the war payoff is increasing in $m_2$, it follows that $W_2(d) > \hat{W}_2(d) = \hat{P}_2(d)$. That is, the war payoff exceeds the best possible peace payoff. Therefore, player 2 will maximize her war payoff, which she does by choosing $\overline{m}_2$, as claimed. $\square$

The intuition for this result is as follows. Given any mobilization by the opponent, a player's own choice can result in either peace or war. The peace payoff is defined as the war payoff plus half of the surplus. Increasing one's own mobilization increases the peace payoff because it increases the war payoff (and thus the minimal terms one can guarantee) and decreases the opponent's war payoff (and thus increases the concessions the opponent will be willing to make). Thus, if peace is going to be the outcome, the player will always maximize his war payoff and reduce the surplus available for negotiation. That is, it always pays to make as many terms non-negotiable as possible. For player 1, eliminating the surplus can only result in peace because he will be able to repay his debt from the concessions: (W) will fail. Maximizing the use of his resources can never provoke war, and it may induce peace. Player 2, on the other hand, has no debt to repay so her concessions must enable player 1 to repay his if they are to avoid war. Maximizing the use of her resources might actually provoke war, but only because her expected war payoff exceeds the best terms she can obtain that would satisfy her opponent. Roughly speaking, she can do better by fighting than giving her opponent enough to repay the debt he has incurred. Thus, both players mobilize everything they can.

It is clear that the magnitude of the debt player 1 has incurred plays a crucial war in determining whether the interaction ends in peace or violence. What remains to be seen is whether player 1 would ever incur a debt that would cause war.

### 4.2 The Optimal Debt

Lemma 2 considerably simplifies the analysis of optimal debt because subgame-perfection allows us to restrict attention to subgames in which players mobilize everything they have. Let $\overline{p}(d) = p(\overline{m}_1(d), \overline{m}_2)$ denote the distribution of power that would result from these allocations. The best peace payoff can be obtained by maximizing $P_1(d)$ assuming that $\overline{p}(d)$ would obtain. The FOC is $(2\pi - d)\overline{p}'(d) = 1 + \overline{p}(d)$, so the optimal "peace" debt is:

$$d_p = \max\left\{0, \frac{\sqrt{2\theta(1-y)[y+\theta(1-y)+2\pi]}}{2} - [y+\theta(1-y)]\right\}. \tag{1}$$

Analogously, the best war payoff can be obtained by maximizing $W_1(d)$ assuming that $\overline{p}(d)$ would obtain. The FOC is $(\pi - d)\overline{p}'(d) = \overline{p}(d)$, so the optimal "war" debt is:

$$d_w = \max\left\{0, \sqrt{\theta(1-y)[y+\theta(1-y)+\pi]} - [y+\theta(1-y)]\right\}. \tag{2}$$

When the optimal war debt is positive, it is always larger than the optimal peace debt: $d_p < d_w \Leftrightarrow 0 < y + \theta(1-y)$. Which of these the player would choose depends on their magnitude and the consequences in the continuation game. We first establish necessary and sufficient conditions for a debt to result in war.

LEMMA 3. *The game will end in war if, and only if,* $\theta > \theta_n$ *and* $d > d^*$, *where*

$$\theta_n = \frac{1-\pi}{1-y} \quad \textit{and} \quad d^* = \frac{(1-\pi)[y+\theta(1-y)]}{\theta(1-y)-(1-\pi)}. \tag{3}$$

*Proof.* Recall that (W) is necessary and sufficient for the game to end in war. With players mobilizing at $\overline{p}(d)$, we can rewrite (W) as $(1-\overline{p}(d))d > 1-\pi$, or

$$[\theta(1-y)-(1-\pi)]\,d > (1-\pi)[y+\theta(1-y)].$$

Since the right-hand side is positive, this inequality cannot be satisfied if $\theta \leq \theta_n$, in which case the game must end in peace. If $\theta > \theta_n$, then (W) reduces to $d > d^*$. □

COROLLARY 1. *If $\theta \leq \theta_n$ or if $d_w \leq d^*$, then player 1 will choose the optimal peace debt $d_p \geq 0$.*

It is not difficult to see why this obtains. If $\theta \leq \theta_n$, then by Lemma 3 the interaction must end peacefully regardless of player 1's allocation. Naturally, he would pick the optimal peace debt. If, on the other hand, $\theta_n < \theta$ but $d_w \leq d^*$, then the *best* war payoff is at a level that admits peace, $d_w \leq S(d_w)$, but then $W_1(d_w) \leq P_1(d_w)$. Since $d_p < d_w \leq d^*$, it follows that $d_p$ also admits peace, and since $W_1(d_w) \leq P_1(d_w) < P_1(d_p)$, the optimal peace debt is preferable to the optimal war debt.

This leaves us with just one case to consider: $\theta_n < \theta$ and $d^* < d_w$. There are two possibilities, depending on the magnitude of the optimal peace debt. If $d^* < d_p$, then the concavity of $P_1(d)$ implies that the *best peace-preserving* debt is $d^*$. But since $d^* < d_w$, and $W_1(d)$ is increasing, it follows that $P_1(d^*) = W_1(d^*) < W_1(d_w)$. Player 1 will choose the optimal war debt, and the interaction will end in war. If, on the other hand, $d_p \leq d^*$, then player 1 will choose the peace debt if $P_1(d_p) \geq W_1(d_w)$, and will choose the war debt otherwise. Since I assumed that indifference between peace and war is resolved in favor of peace, these cases yield the unique SPE of the game:[35]

PROPOSITION 1. *In the unique subgame-perfect equilibrium, player 1 chooses the optimal war debt, $d_w$, if $\theta_n < \theta$, and either $d^* < d_p$ or $P_1(d_p) < W_1(d_w)$, and chooses the optimal peace debt, $d_p$, otherwise. The game ends in war when he chooses the optimal war debt.*

## 5 Discussion

### 5.1 Inevitable War, Inevitable Peace

Proposition 1 states when war can happen in equilibrium, but we would like to know what conditions might make it unavoidable.

RESULT 1 *War is inevitable if the costs of war are sufficiently low and the pre-war distribution of resources is sufficiently unfavorable for player 1.*

Observe what happens when the costs of war become very small, $\pi \to 1$, and player 1's pre-debt resource base becomes negligible, $y \to 0$:

$$\lim_{\pi \to 1, y \to 0} d^* = 0 \qquad \lim_{\pi \to 1, y \to 0} \theta_n = 0$$

$$\lim_{\pi \to 1, y \to 0} d_p = \max\left\{0, \sqrt{\frac{\theta(\theta+2)}{2}} - \theta\right\} \qquad \lim_{\pi \to 1, y \to 0} d_w = \sqrt{\theta(\theta+1)} - \theta > 0.$$

[35] There is a continuum of SPE depending on how the indifference between peace and war is resolved because players can mix. However, all these equilibria are payoff-equivalent, and result in the same choice of debt by player 1.

Since any $\theta > 0$ satisfies $\theta > \theta_n$, one of the necessary conditions for war, there are two possibilities. If $d_p > 0$ in the limit, which will be the case when $\theta < 2$, then the first sufficient condition for war in Proposition 1 obtains. If, on the other hand, $d_p = 0$ in the limit, then $d_w > 0$ implies that $W_1(d_w) > W_1(0) = P_1(0)$, where the equality follows from $d^* = 0$. In other words, the optimal war payoff exceeds the best possible peace payoff, so the second sufficient condition for war in Proposition 1 obtains.

This result is in sharp contrast to existing bargaining models of war, and is solely a consequence of player 1's ability to finance some of his mobilization with debt because $S(0) = 1 - [W_1(0) + W_2(0)] > 0$ means that (W) is never satisfied at $d = 0$, so war would never happen if player 1 could not compensate for his resource deficiency by borrowing.

RESULT 2 *Peace is inevitable if war is sufficiently costly or if the pre-war distribution of resources is sufficiently favorable for player 1.*

Corollary 1 shows that there are two conditions, each of which is sufficient for peace. Consider first $\theta \leq \theta_n$. We can rewrite this inequality as $\pi \leq 1 - \theta(1-y)$, which shows that it will be satisfied when war is costly enough. We can also rewrite it as $y \geq 1 - (1-\pi)/\theta$, which shows that it will be satisfied when player 1 controls a large enough share of the pre-war distribution of resources. Consider now $\theta_n < \theta$. Since $d^* > 0$ in this case but $d_w = 0$ for any $\pi < y + y^2/[\theta(1-y)]$, the second sufficient condition applies for small enough $\pi$ or large enough $y$ (because the right-hand side is strictly increasing in $y$).

### 5.2 Mobilization Efficiency

Since the equilibrium probability of victory for player 1 decreases as his inefficiency increases, his war payoff must go down just as his opponent's payoff must go up for any debt that he might incur in equilibrium:

$$\frac{\partial \overline{p}(d)}{\partial \theta} < 0 \Rightarrow \frac{\partial W_1(d)}{\partial \theta} = (\pi - d)\frac{\partial \overline{p}(d)}{\partial \theta} < 0 \quad \text{and} \quad \frac{\partial W_2(d)}{\partial \theta} = -\pi \frac{\partial \overline{p}(d)}{\partial \theta} > 0,$$

where the second inequality follows from Lemma 1. By the envelope theorem, player 1's optimal war payoff must be decreasing as well:

$$\frac{\partial W_1(d_w)}{\partial \theta} = \left.\frac{\partial W_1(d)}{\partial \theta}\right|_{d_w} = (\pi - d_w) \times \left.\frac{\partial p(d)}{\partial \theta}\right|_{d_w} < 0.$$

Since $P_1(d) = [W_1(d) - d + 1 - W_2(d)]/2$, the envelope theorem also yields:

$$\frac{\partial P_1(d_p)}{\partial \theta} = \left(\frac{1}{2}\right)\left.\left[\frac{\partial W_1(d)}{\partial \theta} - \frac{\partial W_2(d)}{\partial \theta}\right]\right|_{d_p} < 0,$$

so his optimal peace payoff is decreasing as well. Not surprisingly, the less efficient player 1 is at mobilizing his resources, the worse his equilibrium payoff must be.

The effect of mobilization efficiency on the probability of war, however, is non-monotonic.

RESULT 3 *War cannot occur if player 1 is either very effective or very ineffective at mobilizing his resources. If war can occur, it does so only when player 1 is moderately effective.*

Corollary 1 shows that when $\theta \leq \theta_n$, peace must always prevail. Consider now some $\theta_n < \theta$. Since

$$\lim_{\theta \to \theta_n^+} d_w = \sqrt{(1-\pi)(1+y)} - y - (1-\pi) < \lim_{\theta \to \theta_n^+} d^* = +\infty,$$

Corollary 1 further implies that peace will prevail for $\theta$ greater than, but sufficiently close to, $\theta_n$. Since

$$\frac{\partial d^*}{\partial \theta} = -\frac{(1-\pi)(1-y)(1-\pi+y)}{[\theta(1-y)-(1-\pi)]^2} < 0$$
$$\frac{\partial d_w}{\partial \theta} = \frac{(1-y)(y+\pi) + 2\theta(1-y)^2}{2\sqrt{\theta(1-y)\left[y+\theta(1-y)+\pi\right]}} - (1-y) > 0,$$

where the second inequality follows from $y + \pi > 0$, it follows that as $\theta$ increases further, there exists $\theta_c$ such that $d^*(\theta_c) = d_w(\theta_c)$. For $\theta_c < \theta$, both necessary conditions for war are satisfied: $\theta_n < \theta$ and $d^* < d_w$. Proposition 1 shows that now war can occur either because $d^* < d_p$ or because $P_1(d_p) < W_1(d_w)$. The optimal peace payoff is non-monotonic in $\theta$:

$$\frac{\partial d_p}{\partial \theta} \gtreqless 0 \Leftrightarrow \theta_p \equiv \frac{\left(\sqrt{2}-1\right)(y+2\pi)}{2(1-y)} \gtreqless \theta.$$

That is, $d_p$ is increasing if $\theta < \theta_p$, and decreasing if $\theta_p < \theta$. Since $d^*(\theta)$ is bounded away from zero and $d_p(\theta) = 0$ for sufficiently high $\theta$, this implies that $d^*(\theta)$ and $d_p(\theta)$ may either never intersect, or intersect at most twice. If they do not intersect, then war will never occur if $P_1(d_p) \geq W_1(d_w)$ for all $\theta$. If they do intersect, then war must occur for any values where $d^* < d_p$. Observe now that if war does occur at intermediate levels of efficiency, peace must still prevail as player 1's efficiency becomes sufficiently low. This is because $W_1(d_w)$ is decreasing in $\theta$, which means that there exists some $\overline{\theta}$ such that $W_1(d_w(\overline{\theta})) = P_1(0)$. But since $d_p(\overline{\theta}) = 0 < d^*(\overline{\theta})$, and $W_1(d_w(\theta)) < P_1(0)$ for any $\theta > \overline{\theta}$, peace must prevail for all such $\theta$.

Why do both high efficiency and low efficiency promote peace? We have already seen what makes peace inevitable, so consider a situation, such as Figure 1, in which war will occur for $\theta \in (0.50, 1.67)$ even though $d_p(\theta) < d^*(\theta)$. When player 1 is relatively efficient, i.e. $\theta < 0.50$, at converting resources to military allocations, the distribution of power, $\overline{p}$, would significantly favor him, even if he is resource-constrained. Furthermore, borrowing even small amounts results in serious improvement of his military position. Player 1 thus enjoys a double advantage because player 2 is quite willing to concede the additional amount that player 1 would need to repay his debt: the extra concession is small, and her war payoff not that great to begin with. The optimal strategy here is to borrow.

When player 1 is not very efficient at converting his resources into military allocations, i.e. $\theta > 1.67$, he suffers the reverse double whammy: the distribution of power he can achieve for any resource level is quite unfavorable (which means that his opponent's minimal terms are very demanding), and even marginal improvements can only be financed by borrowing very large amounts (which she would not concede). This makes borrowing unattractive, and player 1 simply agrees to the terms he can obtain at the existing distribution of resources. The optimal strategy here is to incur no debt at all.

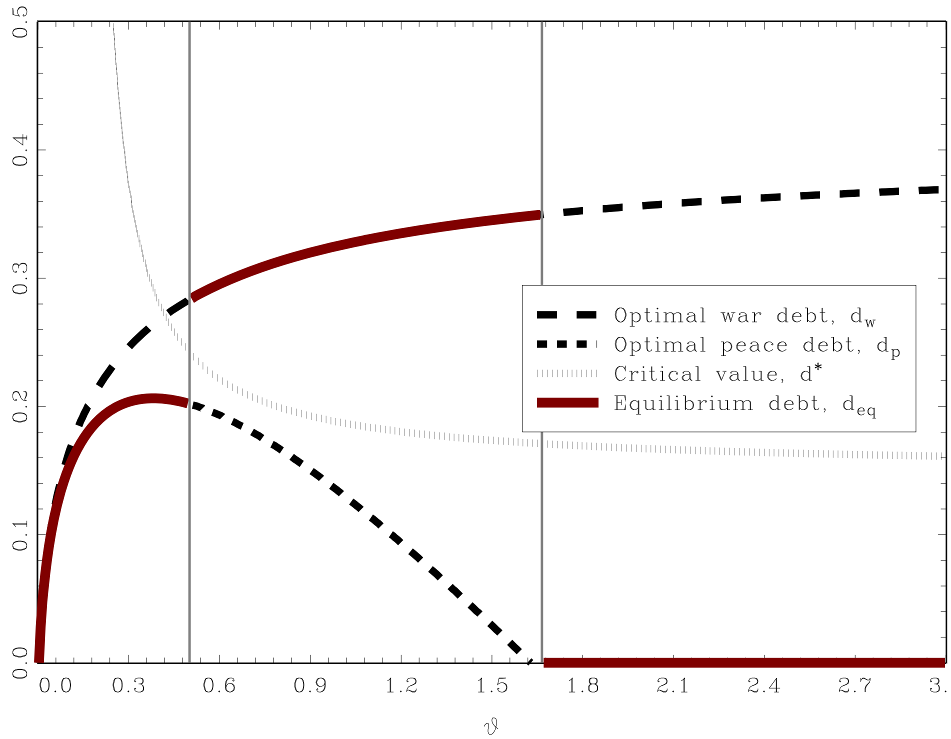


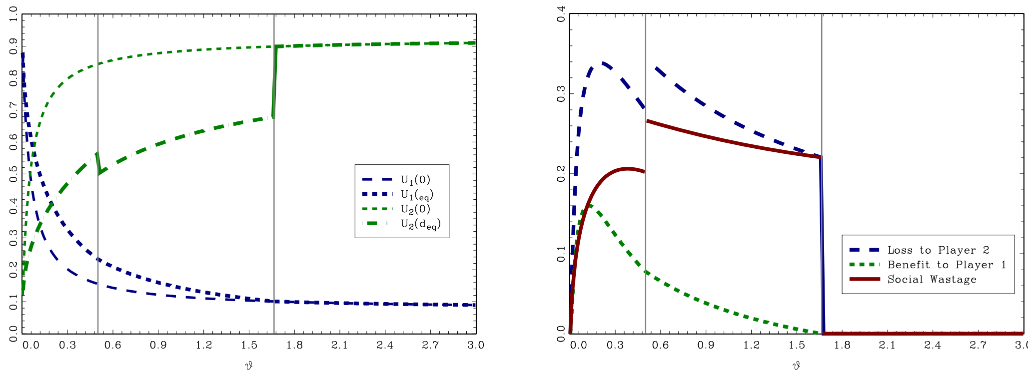

Figure 1: Mobilization Efficiency and War, $y = 0.05, \pi = 0.85$.

It is difficult to say how the debt varies in mobilization efficiency in general. Figure 1 that the optimal positive peace debt can first increase but then decrease before it becomes optimal to incur a debt that precludes peace, in which case player begins the really heavy borrowing.

### 5.3 War Finance and the Coercive Use of Debt

As we have seen, player 1 borrows much more heavily when he is financing a war than when he is trying to get the opponent to offer better terms in peace. To see the effect of debt financing, we will compare the situation in which player 1 cannot borrow with a situation in which he can. Figure 2(a) shows the equilibrium payoffs for the two players under both scenarios. The parameters are the same as in Figure 1, so when borrowing is possible war would occur for $\theta \in (0.50, 1.67)$, and would not occur otherwise (recall that when player 1 cannot borrow, war never occurs in equilibrium). Figure 2(b) shows player 1's benefit from borrowing (the difference between his equilibrium payoffs with debt financing and without), player 2's losses (the analogous difference between her payoffs), and the social wastage (the share of the pie that is a loss in her payoff but that does not result in a gain for player 1).

Consider first the *coercive* use of debt, which player 1 employs when he is relatively efficient at resource mobilization ($\theta < 0.50$). The interaction will end peacefully in both scenarios, but player 1 can improve his payoff by forcing concessions from his opponent. This improvement, however, is much smaller than what player 2 agrees to lose: the social




(a) Payoffs. (b) Coercion and Wastage.

Figure 2: The Benefits and Losses of Debt Financing, $y = 0.05, \pi = 0.85$.

wastage is precisely the debt that player 1 incurs to fund his coercive mobilization. This is not surprising: since the interaction will end in peace negotiations, player 1 would have to repay the debt with certainty. His relative mobilization effectiveness does allow him to convert some of it into better terms, but most of the concessions have to go to retiring the debt. The overall effect can be dramatic. For example, at $\theta = 0.35$, the optimal peace debt is approximately 21% of the total benefit. Player 2's loss is about 32%, but only 11% translates into a gain for player 1. If player 1 could only rely on the resources he has without borrowing, he would secure approximately 19% of the benefit, with player 2 gobbling up the rest. By borrowing, he manages to obtain about 30%, and his opponent's share drops to approximately 49%.

RESULT 4 *Player 1 can borrow in order to coerce player 2 into significant concessions only if he is relatively efficient at mobilizing his resources.*

Consider now *war financing*, which player 1 resorts to when he is moderately efficient at resource mobilization. The interaction now will end in fighting when player 1 can borrow and peace when he cannot. Since player 1 can always choose not to borrow, whenever he incurs positive debt in equilibrium, his payoff is strictly higher than not doing so, even when it leads to war. Consider $\theta = 1.00$, where the debt burden is quite heavy, at roughly one-third of the total benefit. Since player 1 is not very effective at converting his resources into military allocations, the improvement in his expected share of the benefit is small (from 12% in peace without debt, to 15% in war and heavy debt). While he enjoys a modest 3% improvement, player 2's expected loss is about 27% of the benefit. The enormous social waste amounting to 24% is due to a combination of war costs and debt payments if player 1 should emerge victorious. In contrast to the peace scenario, this is less that what player 1 borrowed because he would repudiate the debt if he loses the war.

How does the debt benefit player 1? Since the original distribution of resources is unfavorable and he is not very effective at mobilizing what he has, player 1 can only manage an optimal debt-free mobilization which results in barely 5% probability of winning. This unfavorable distribution of power can only result in disadvantageous peace terms. With access to credit, the best he can do without provoking war is $d_p = 0.16$ (see Figure 1), with the resulting probability of winning going up to 16%. Since he would have to repay this debt for sure, the improvement in the peace terms is marginal, to 13.5%. Borrowing optimally for war, however, allows him to increase the probability of winning to 28%. Because he is relatively inefficient, the amount he has to borrow to obtain such a favorable distribution of power is way beyond the maximal concession that player 2 would be willing to make: she would not give up more than about 39% of the benefit, and since player 1 would have to repay the entire debt if negotiations end in peace, accepting such terms would net him a paltry 6% after he settles his account. This is less than half of what he expects to secure by fighting because he would only have to repay the debt if he wins. Player 1 thus does better by plunging into war.

RESULT 5 *If player 1 is only moderately efficient at mobilizing his resources, he must borrow heavily in order to coerce player 2. Because in peace he must repay the debt but in war he must only do so when he loses, player 1 would borrow even more, to the point where player 2 would be unwilling to agree to the minimal terms that player 1 can secure by war.*

Of course, if player 1 is too inefficient at mobilizing his resources, then neither coercion nor war financing would be attractive options: he is strictly better off accepting the minuscule terms player 2 would deign to offer at the distribution of power that would result from debt-free mobilization.

### 5.4 A Commitment Problem

The mechanism in the war finance model can be compared, roughly, to two of the existent rationalist explanations for war between two unitary actors. First, recall that war can occur when power shifts between the actors faster than they can negotiate interim compensations and when the difference between the military power of the declining state before and after the shift is so large that the payoff she can secure by fighting today outweighs any possible concession the opponent can make now given how much he would be able to extract tomorrow. If the opponent could commit not to exploit his future military advantage to its fullest, then war would be avoided today. The opponent actually strictly prefers to be able to make such a commitment because it would enable him to avoid fighting while he is still weak. Unfortunately, once the power shift is complete, there is nothing to keep him from reneging on any such promise. Because the declining actor knows this, she starts a preventive war.

In a way, a partial cause of war in this model is also a credible commitment problem: players cannot promise not to utilize their resources to maximum military or bargaining advantage once player 1 has decided how much to borrow. To see this, note first that:

$$\overline{p}(d) = \frac{\overline{m}_1(d)}{\overline{m}_1(d) + \overline{m}_2} = \frac{y + d}{y + d + \theta(1 - y)},$$

so we can think of $\theta$ as the relative effectiveness of a unit of resources mobilized by player 2 to a unit of resources mobilized by player 1. With $\theta = 1$, they are equally effective, with $\theta < 1$, player 1 is more effective, and with $\theta > 1$, player 2 is. Thus, $\theta(1 - y)$ could be thought of as the "relevant unit of resources" committed by player 2. We can then represent player 2's decision to commit only a portion of her total resources, so that $m_2 < 1 - y$, by taking a *smaller* value of $\theta$. The effect would be the same: the value of each additional unit of resources committed by player 1 would increase. This now implies that war can always be avoided if player 2 were to forego some of the advantage the distribution of resources accords her. For instance, consider the example we have been using so far at $\theta = 0.50$, in Figure 1. The equilibrium debt is $d_w \approx 0.28$, and the outcome is war in which player 2's expected payoff is about 0.50.

If player 2 were to limit her spending to, say, 49% of her resources ($\theta = 0.49$), then the equilibrium debt would be $d_p \approx 0.20$, the outcome would be peace, and player 2's payoff would be 0.56. Since player 1's payoff is decreasing in $\theta$, it follows that *both* players would benefit if player 2 were to limit her mobilization. The problem is that she cannot credibly commit to doing so. In the second scenario, player 1's equilibrium mobilization would be $\overline{m}_1(d_p) = y + d_p = 0.25$, and since player 2 is limiting her mobilization to $m_2 = (0.49)(1 - y) \approx 0.47$, the resulting distribution of power would be $\overline{p}(d_p) \approx 0.35$. If player 2 were to deviate and mobilize all of her available resources, she could make that distribution a lot more favorable to herself: $\hat{p} = 0.25/(0.25 + 0.95) \approx 0.21$. We now obtain: $S(d_p) = 1 - \pi + \hat{p}d_p \approx 0.19 < d_p$, so (W) would be satisfied, and war would be inevitable. In that war, however, player 2's expected payoff would be $(1 - \hat{p})\pi = 0.67$, which is much better than the proposed peace terms that she would obtain by limiting her mobilization (0.56). Thus, her promise to constrain herself is not credible, and the players end up in the equilibrium where she obtains even less (0.50).

There is a reason I said that the commitment problem is a *partial* cause of war in this model. As Figure 2(a) shows, the *best* peace payoff player 2 can obtain, at $\theta \approx 0.49$, might well be strictly worse than her equilibrium war payoff (e.g., at $\theta = 1$). In this situation, limiting her mobilization to 49% of her available resources would still avoid war but it would certainly not be in her interest to do. Contrary to the situation we examined previously, this is not an instance in which she would have liked to be able to commit credibly to limiting her forces. The other cause of bargaining breakdown is the relatively large concession she would have to make to preserve the peace given how much player 1 has borrowed.

### 5.5 The Inefficient Peace

This brings us to the second mechanism of war under complete information that is related to this one: the costs of maintaining the status quo. In this case, the actors have to forego some consumption in order to maintain a force sufficient to deter the opponent from attacking. War can occur when the burden of defense is heavier than the costs of a war that might eliminate one of the actors and allow the opponent to enjoy the full consumption of his resources. It is worth noting that there is a lurking commitment problem underpinning this explanation as well: if players could credibly promise not to allocate "too much" of their resources to the military, then they would become easier to deter, which would free up resources for consumption and decrease the costs of the status quo. The problem is that once a player makes his allocation decision, the opponent has no incentive to abide by such a promise if attacking him comes with a high probability of victory.[36] It is worth

[36]In Powell's (1993) model, players make their military allocation decision sequentially but the same logic would extend to a situation, like the one in this model, in which decisions are made simultaneously. If peace is

noting, however, that if players *could* agree to disarm, then there is nothing to prevent them from doing so: they would allocate all their resources to "butter", so there would be no opportunity cost of foregone consumption, and hence no incentive to renege by arming and attacking to eliminate the opponent. The commitment problem would disappear, and with it, the breakdown of peace. This is so because both players can benefit from disarming, which, as we have seen, might not be the case in the war finance model. Given the debt player 1 has chosen to incur, player 2 might have no incentive to limit her mobilization because avoiding war requires too large a concession to player 1.

The crucial feature of the war finance model is the costliness of peace. War is inevitable when player 1 borrows so much that the terms he needs to secure in order to repay this debt and enjoy some benefit exceed the terms his opponent is willing to concede given how well she expects to do in war. As we have seen, when player 1 borrows to improve his military position, he can coerce her into granting better terms simply because he shifts the distribution of power in his favor. However, because he is committed to repaying the debt when negotiations end in peace, the concessions player 2 must agree to are disproportionately large: they must cover *both* what player 1 can secure by fighting and what he has to pay if peace prevails. Player 2 might be willing to do so, but only up to a point. The bargaining range closes because player 1's minimal demands exceed player 2's maximal concessions. This can never happen in the traditional bargaining model of war, and it is worth exploring why it does in this one.

Recall that in the traditional model, peace is "free" (efficient): if players avoid war, they distribute the entire benefit between themselves and enjoy the benefits of their shares in their entirety. Since war is costly, and both players know it, their expected payoffs from fighting can never sum to the total benefit, regardless of the distribution of power. No matter how they mobilize their resources, there always exist peace settlements that yield both players more than their expected war payoffs. Because there are no costs players would have to pay once they agree on such terms, any such deal is preferable to war for both. The bargaining range can never close, and no player would ever attack to overturn a settlement in that range. In other words, the minimum terms each demands are always smaller than the maximum the other would agree to because both minimal demands and maximal concessions are determined entirely by the war payoffs.

The situation in this model is vastly different because peace is not free: if player 1 incurs any debt (which he usually does in order to compensate for an unfavorable distribution of resources), then avoiding war commits him to repayment. Even though players would distribute the entire benefit among themselves, player 1 will not enjoy the benefits of his share in its entirety: a portion has to go toward retiring the debt. Because war is costly, the expected payoffs from fighting sum up to less than the size of the benefit regardless of the distribution of power. In contrast to the traditional model, player 1's payoff from fighting is even worse because he would have to repay the debt if he wins. Thus, debt financing

to be sustained in equilibrium at lower military allocations, neither player should be able to profit by deviating to a larger allocation and attacking. In equilibrium, players know each other's strategies, so a deviating player would know how much the opponent would allocate even when the decisions are simultaneous. If a player can benefit from increasing his allocation and attacking given the opponent's proposed equilibrium allocation, then peace would be unsustainable in equilibrium. For an extended discussion of endogenous maintenance of peace, see Leventoğlu and Slantchev (2007).

does not somehow make war efficient; in fact, it is even less so. What really matters is that borrowing makes peace inefficient. Because peace requires repayment and in war only victory does so, peace deals that satisfy the players' expected payoffs from fighting might not be enough to make them preferable to war. The simple reason is that peace itself is costly, so for a player to prefer it to war, its terms must be sufficiently attractive to deliver what he expects to gain by fighting plus a compensation for the losses he must incur in maintaining it.

RESULT 6 *War can happen when military mobilization is financed by borrowing because the need to repay the debt makes peace inefficient.*

It is important to realize that debt must not be simply a type of sunk cost, as it would be if player 1 were committed to repaying it regardless of the war outcome. If this were the case, then $W_1(d) = p(d)\pi - d$, so $S(d) = 1 - \pi + d$. In this situation (W) could never be satisfied, and the interaction would always end peacefully. The intuition is that peace terms are defined in terms of the expected payoff from war, and if the cost of the debt is sunk, then it would reduce both peace and war payoffs by the same amount. The only possible benefit would be in how it improves the probability of winning, and through that, the terms of peace: he would accept any deal such that $x - d \geq p(d)\pi - d$, or simply $x \geq p(d)$. Player 1 might still incur a positive debt but he would never go up to amounts that would provoke war. Thus, there must be a wedge between the cost of debt in peacetime and the cost in wartime. It should be clear, however, that full repudiation in case of defeat is not necessary for the results: it would be sufficient if player 1 were simply less likely to repay the debt (or pay only a fraction of it) if he loses the war. It should also be clear that it would be relatively straightforward to incorporate interest, so that player 1 would have to pay more than the principal. (This is because mobilization efficiency determines how useful a unit of debt would be for military purposes. We shall return to this in the final section.) What really matters is the difference in how much he must pay per unit of debt in peace and how much he expects to pay per unit of debt if war occurs. If the expected cost of debt is smaller when war occurs (e.g., because of repudiation or even partial default), then debt financing becomes an attractive strategy even though it might provoke war.

### 5.6 War and the Bargaining Range

These results point to what seems to me a rather fundamental limitation of the traditional model of war as a result of bargaining breakdown: its assumption of a costless peace. More generally, we can think of fighting as a dispute resolution mechanism (DRM) which is both risky and costly because war is unpredictable and destructive. The traditional assumption is that war is costlier than any alternative peaceful DRM. The puzzle, then, is why players opt to use such an inefficient mechanism rather than any of the others. This is a very useful first cut, but we need to move forward. The problem is that the peaceful alternatives are never modeled explicitly: instead they are simply assumed to be efficient (or at least less costly than war). It would appear that scholars have in mind DRMs such as negotiations, arbitration, or mediation, and even though these inevitably occur in the shadow of power, very little attention has been paid to the determinants of that power. If actors must continuously invest in their military forces to maintain the status quo or if they have borrowed in order to compensate for their resource disadvantage, then they have to reckon with the burden of peace. It might be difficult to accept that such a burden can ever be heavier to bear than that of war, but this might be an artifact of focusing on the especially ruinous interstate wars (e.g., the Peloponnesian War, the Thirty Years' War, the Napoleonic Wars, the two World Wars) to the neglect of many smaller, but often quite important, conflicts (e.g., the Wars of Italian Unification, the Franco-Prussian War, Khalkhin Gol, the Sino-Indian War.)[37]

From a theoretical perspective, it is important to emphasize Powell's (2006, 179-80) point that when war is the most inefficient DRM, the bargaining range will never be empty:

> The fact that fighting is costly implies that there are always agreements the states prefer to fighting even if the states are risk-acceptant or there are large first-strike or offensive advantages. If one thinks of war as a costly lottery, all of the states would do better by agreeing to the equivalent costless lottery, that is, a lottery in which the states' chances of winning are the same and there are no costs.

War under these conditions can result from various manifestations of the fundamental commitment problem arising from large, rapid power shifts which furnish actors with incentives to renege on Pareto-superior agreements that would have avoided war.

When actors have to bear peace-time costs, war might no longer be the most inefficient DRM. The war finance model is actually based on the assumption that if the bargaining range is not empty, then war would be avoided. As (W) makes clear, if peace is efficient ($d = 0$), then the bargaining range will exist in the war finance model just as it does in the traditional one. We then explored reasons for the closure of that range, and therefore, war. This is in sharp contrast to the traditional complete-information approach which seeks to explain why war might occur even though the bargaining range is not empty. The traditional question is why actors fail to agree on peaceful settlements that both prefer to war when such agreements exist. The war finance question is why there might be no agreements that both sides prefer to war.

RESULT 7 *The traditional complete-information approach explains war as a failure to agree on a mutually-acceptable peaceful settlement from the existing non-empty bargaining range. The war finance approach explains war as a consequence of actions that eliminate the bargaining range so that there are no mutually acceptable peace settlements.*

One important consequence of the traditional assumption that war is the most inefficient DRM is that when war occurs in equilibrium, it is never the case that both actors are willing to fight. Instead, one of them imposes the war DRM on the other even though the latter would have preferred to avoid war altogether. This is most evident in the preventive war scenario in which the rising actor desperately wishes he could induce the declining actor not to initiate an attack but the size of the power shift and the inability to commit not to exploit his advantage prevent him from doing so even when he would concede the entire benefit today. An analogous situation occurs with first-strike advantages where the actor being attacked desperately wishes he could induce the opponent not to exploit that advantage but

[37] I must emphasize that we are taking a rather leader-centric view of war here. If the actual societal costs of fighting are figured in, it is plausible to argue that war must be the most inefficient DRM ever designed. Historically, however, leaders (and governments) never fully internalize the costs of conflict, so it is reasonable to take the perspective we have.

his own inability to commit to forego it when given a chance to use it prevents him from doing so. The wars that occur in these models are *imposed* by one actor on an unwilling opponent who is forced to fight.

There are certainly many wars that appear to fit this characterization rather well but then again there are also many wars in which both sides were rather willing participants, at least at the outset. At first glance, it would appear that incomplete information might account for these cases: both actors believe that they can obtain better terms by fighting than what the opponent is willing to concede in peace. These incompatible beliefs arise from private information about their capabilities, resolve, or costs of war. The problem is that these models also typically assume that peace is costless, which means that the bargaining range always exists. When war occurs, at most one of the actors would be spoiling for a fight, never both. Incomplete information might actually make matters worse because in some formulations when war occurs, *neither* actor wants to fight. This is easiest to see in Fearon's (1995) canonical model that assumes uncertainty over the costs of war. Letting $\underline{c}_i > 0$ be the lowest possible cost of fighting that player $i$ might have, the set of agreements $[p - \underline{c}_1, p + \underline{c}_2]$ *always exists* regardless of the uncertainty due to private information. Is is readily verified that *both actors prefer any one of these settlements to war regardless of their beliefs or their own type*. The wars that occur in this model are *wars of regret* because both actors would have liked to have agreed on one of these existing deals. What prevents them from doing so is not exactly clear. This makes the mechanism provided by the model particularly suspect as an explanation of war.[38]

In contrast, the war finance approach focuses on reasons for non-existence of the bargaining range. The wars that occur in this model are *wars of choice* because each player would rather fight than agree to the peace terms that the opponent is willing to offer. Given the debt that player 1 has *chosen* to incur, neither player has incentives to limit their mobilization even when doing so could avoid war. Both players *choose* to mobilize all their resources and fight because there is no deal that can simultaneously satisfy both actors. Player 1 fights because player 2 would not concede enough to enable him to repay his debt, and player 2 fights because her expected payoff from war is higher than the payoff from a peace that would be satisfactory for player 1. Crucially, the action that eliminated the bargaining range is *deliberate*, taken in the full knowledge that it would create a situation in which war would be inevitable. Player 1's incentives to incur debt at the unsustainable war-finance level, rather than at the moderate one intended for coercion, are driven by the wide disparity in pre-crisis distribution of mobilizable resources and his moderate efficiency in converting them to military assets.

RESULT 8 *In contrast to the traditional efficient-peace setting which can explain only imposed wars and wars of regret, the war finance approach explains wars of choice, which result from deliberate actions that render war a mutually acceptable dispute resolution mechanism.*

[38]This particular problem extends to *any* model where the uncertainty is about the costs of war. Slantchev (2009) argues that these models provide, at best, very weak explanations for war and compares them to models where the uncertainty is over the distribution of power. See Fey and Ramsay (2007) for a comparison of different types of uncertainty in the traditional setup with efficient peace.

## 6 Debt Servicing

Thus far, we have neglected the supply price of the loan. Let $r \geq 0$ be an alternative risk-free return on the amount lent to player 1. If the lenders are atomistic, market-clearing implies that the value of expected debt servicing must equal the value of the alternative risk-free investment. Since player 1's borrowing is meant for mobilization and a (possibly implied) threat of war, the risk premium would have to be paid regardless of the outcome of the crisis. This means that in equilibrium, it must be the case that $(1+r)d = p(d)D(d)$, so

$$D(d) = \frac{(1+r)d}{p(d)}, \tag{4}$$

where $D(d)$ is the debt-servicing schedule that player 1 is committed to.[39] Note that we have maintained the assumption of debt-repudiation in case of military defeat. Observe that (4) must hold in *equilibrium*, not in general. The debt service schedule must be set at the time player 1 borrows $d$ and it depends on the probability of victory, $p(d)$, even though this probability would not be determined until players make their military allocations. When they mobilize, the debt and the service schedule are already set, so the changes in the distribution of power that result from their mobilization choices cannot influence the debt schedule itself. In equilibrium, the optimal mobilization strategies would determine what $p(d)$ would be once players get to make these choices, so (4) would have to obtain.[40]

The game is the same as before except that now player 1 must repay the debt $d$ according to the constraint in (4). His war payoff is now $W_1(d) = p(d)(\pi - D(d))$, and he would not fight to overturn any deal such that $x - D(d) \geq W_1(d)$. Since $W_2(d) = (1-p(d))\pi$ is the same as before, the bargaining range is $[W_1(d) + D(d), 1 - W_2(d)]$, and the surplus is $S(d) = 1 - [W_1(d) + W_2(d)]$. War would be inevitable if $D(d) > S(d)$, or:

$$(1 - p(d))D(d) > 1 - \pi. \tag{WD}$$

If peace prevails, player 1's share will be

$$\widetilde{x}^*(d) = \frac{W_1(d) + D(d) + 1 - W_2(d)}{2},$$

and his peace payoff, $P_1(d) = \widetilde{x}^*(d) - D(d)$.

Since $D(0) = 0$, the proof of Lemma 1 can be adapted to show that $D(d) \in [0, \pi)$ in any equilibrium. Furthermore, since the debt service schedule is already set by the time players make their military allocations, $D(d)$ is constant in $m_i$, so the proof of Lemma 2 is easily adapted (by substituting $D(d)$ for $d$) to show that in equilibrium they would mobilize at the maxima permitted by their resources for any given $d$ and $D(d)$. This now implies that in any equilibrium, the distribution of power would be $\overline{p}(d) = p(\overline{m}_1(d), \overline{m}_2)$, as before.

LEMMA 4. *The game will end in war if, and only if, $\theta > \theta_n/(1+r)$ and $d > \widetilde{d}^*$, where*

$$\widetilde{d}^* = \frac{y(1-\pi)}{\theta(1-y)(1+r) - (1-\pi)}.$$

[39] This follows the idea in Grossman and Han (1993). Their model is not strategic, there is no second player (or indeed bargaining), and they look at a situation where war is inevitable.

[40] In other words, $D(d)$ should be treated as a constant when taking derivatives in $m_i$.

*Proof.* Since players mobilize at their unconditional maxima in any equilibrium, we can rewrite (WD) as $d(1-\overline{p}(d))/\overline{p}(d) > (1-\pi)/(1+r)$, or:

$$d(1-\zeta) > y\zeta, \quad \text{where} \quad \zeta = \frac{1-\pi}{\theta(1-y)(1+r)} > 0. \tag{5}$$

If $\zeta \geq 1$, this condition cannot be satisfied, and peace must necessarily prevail. Thus, a necessary condition for war is $\zeta < 1$, which reduces to $\theta > \theta_n/(1+r)$. If this inequality is satisfied, solving (5) for $d$ yields the value of $\widetilde{d}^*$ specified in the lemma. □

The optimal war debt can be found by maximizing $W_1(d)$ under the assumption that (4) holds and $\overline{p}(d)$ obtains:

$$\frac{\partial W_1}{\partial d} = (\pi - D(d))\frac{\partial \overline{p}}{\partial d} - \overline{p}(d)\frac{\partial D}{\partial d} = \pi\frac{\partial \overline{p}}{\partial d} - (1+r),$$

where we used:

$$\frac{\partial D}{\partial d} = (1+r)\,\frac{\overline{p}(d) - d\,\frac{\partial \overline{p}}{\partial d}}{\overline{p}(d)^2} > 0.$$

The FOC defines a quadratic, whose positive root is the optimal war debt:

$$\widetilde{d}_w = \max\left\{0, \sqrt{\frac{\pi\theta(1-y)}{1+r}} - [y + \theta(1-y)]\right\}. \tag{6}$$

Since $\widetilde{d}_w$ is decreasing in $r$, it follows that an increase in the alternative risk-free rate of return decreases the amount that player 1 would borrow to finance a war. This comparative static is intuitive: player 1 would have to increase the amount of debt servicing to attract lenders, and this makes borrowing more expensive, and therefore less attractive. We can now establish sufficient conditions for the interaction to end in war.

PROPOSITION 2. *If the existing distribution of resources is sufficiently favorable to player 2, the costs of war are sufficiently low, and $\theta < 1/(1+r)$, then the game will end in war.*

*Proof.* It is sufficient to establish that the conditions enumerated in the proposition ensure that (WD) is satisfied, so war must be inevitable. Observe now that

$$\lim_{y\to 0,\,\pi\to 1} \widetilde{d}^* = 0 \quad \text{but} \quad \lim_{y\to 0,\,\pi\to 1} \widetilde{d}_w = \sqrt{\frac{\theta}{1+r}} - \theta.$$

Since any $\theta > 0$ would satisfy the necessary condition in the limit, taking $\theta < 1/(1+r)$ is sufficient to ensure that $\widetilde{d}_w > 0$ there as well. □

The optimal peace debt does not have a tractable closed form, but it is not difficult to show that it is decreasing in $r$, just like the optimal war debt.[41]

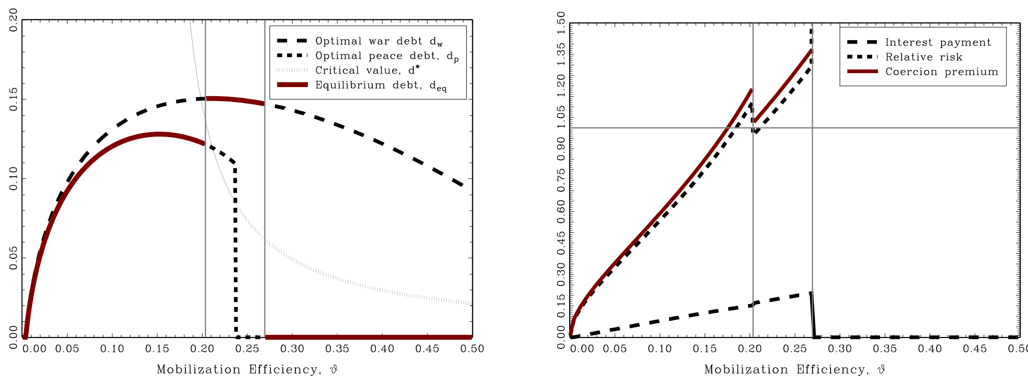
[41]The optimal peace debt can be found by maximizing $P_1(d)$ assuming that (4) holds and $\overline{p}(d)$ obtains.

## 6.1 Coercion Premia in War and Peace

How much must player 1 pay over the alternative rate of return in order to secure the financing for the mobilization he wants? The coercion premium is defined as the difference between the interest rate player 1 must pay for his optimal debt and the alternative (risk-free) rate of return, $[D(d) - d]/d - r$, which is more conveniently expressed as:

$$C(d) = (1 + r)\left[\frac{1 - p(d)}{p(d)}\right],$$

the risk-free return multiplied by the relative risk of repudiation. We now examine a scenario analogous to the one we analyzed before in Figure 1 except that now player 1 has to offer a rate of return that would attract lending given the risk-free alternative $r = 6\%$.




(a) Optimal Debt. (b) Coercion Premium.

Figure 3: Mobilization Efficiency, Debt Service, and War, $y = 0.05, \pi = 0.85, r = 0.06$.

Figure 3(a) shows that introducing debt service makes the optimal debt smaller and war less likely (in that it occurs over a smaller range of parameters). The overall dynamics are, however, exactly the same as in the simpler model, so the substantive implications continue to hold.

Turning now to Figure 3(b), we can examine how the interest payments, $D(d) - d$, and the coercion premium change as a function of mobilization efficiency. The first finding is that as player 1 becomes less effective at resource mobilization, his premium and his

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Since:

$$\frac{\partial P_1}{\partial d} = \left(\frac{1}{2}\right)\left[\frac{\partial W_1}{\partial d} - \frac{\partial W_2}{\partial d} - \frac{\partial D}{\partial d}\right],$$

so the FOC is:

$$(2\pi - D(d))\frac{\partial \overline{p}}{\partial d} = (1 + \overline{p}(d))\frac{\partial D}{\partial d}.$$

which, unfortunately, defines a quartic equation:

$$\frac{2\pi}{(y + d + \theta(1 - y))^2} - \frac{y(1 + r)}{(y + d)^2} = \frac{2(1 + r)}{\theta(1 - y)}. \quad (7)$$

Let $\widetilde{d_p}$ be the largest real root of (7) if it is positive and 0 if it is negative. The FOC shows that as $r$ increases, $\widetilde{d_p}$ has to decrease in order to maintain the equality.

interest payment (which he would make conditional on not losing) increase even though the amount he borrows is non-monotonic. The intuition is that mobilization inefficiency increases the relative risk even when player 1 borrows more to offset this disadvantage. The coercive premium depends on the amount borrowed only indirectly through its influence on the relative risk. Increasing the relative risk makes the premium grow at a faster rate, which explains why interest payments continue to increase even when the amount borrowed actually declines (e.g., $\theta \in (0.15, 0.20)$).

RESULT 9 *Increasing mobilization inefficiency increases the coercive premium and the interest payments even though the amount borrowed may decline.*

Figure 3(b) also reveals that although it is very large, the coercive premium player 1 must pay when the interaction ends in war is not necessarily larger than the coercive premium he must pay when it ends in peace. In particular, for $\theta \in (0.204, 0.236)$, the war premium is strictly smaller than the highest coercive peace premium, and because of this, the corresponding interest payment is also smaller. For $\theta \in [0.236, 0.270)$, on the other hand, the war premium and interest payments are strictly higher than the highest coercive peace premium. The key to this difference is in the amount player 1 borrows and how it affects the relative risk of repudiation. When the equilibrium switches from peace to war, the optimal debt jumps up (recall that optimal war borrowing is always higher than optimal coercive borrowing). This increases the probability that player 1 would prevail and therefore decreases the relative risk. As a result, the coercive premium declines. However, as player 1 becomes less efficient, an increase in the amount of debt leads to a disproportionately smaller improvement in his ability to win, so the relative risk increases at a faster rate. This makes debt servicing more expensive and decreases the optimal amount player 1 would borrow, which in turn decreases his ability to win and results in a higher relative risk in equilibrium. The upshot is an increase in the coercion premium and interest payments.

RESULT 10 *Although high, the war premium player 1 would have to pay might be smaller than the peacetime coercive premium provided he is efficient enough so that the increased borrowing results in a large enough improvement of his ability to win and thus in a lower relative risk.*

I should note that this result depends on how we define relative risk. The premium depends on the probability that player 1 would win a war even if such a war is never fought in equilibrium. I justified this assumption with the idea that since the negotiated outcome depends on the (implied) threat of war, the relevant payoff is what player 1 expects to get if such a war actually were to be fought. However, it is also the case that lenders might not know whether the crisis would end in war, in which case it would be wise to demand a rate of return as if it would. An alternative possibility would be to explore a political economy model in which lenders' expectations (and therefore the rate they demand) are consistent with the equilibrium outcome of the crisis.

### 6.2 Prosperity and War

As we have seen, the optimal debt, be it for coercion or war-fighting, decreases in the risk-free alternative rate of return. One might think that this would imply that higher rates should be associated with lower likelihood of war, but unfortunately things are not that simple. Figure 4 shows the equilibrium debt level (and crisis outcome) for $\theta = 0.20$, the level of efficiency that we know results in peace if $r = 0.06$.

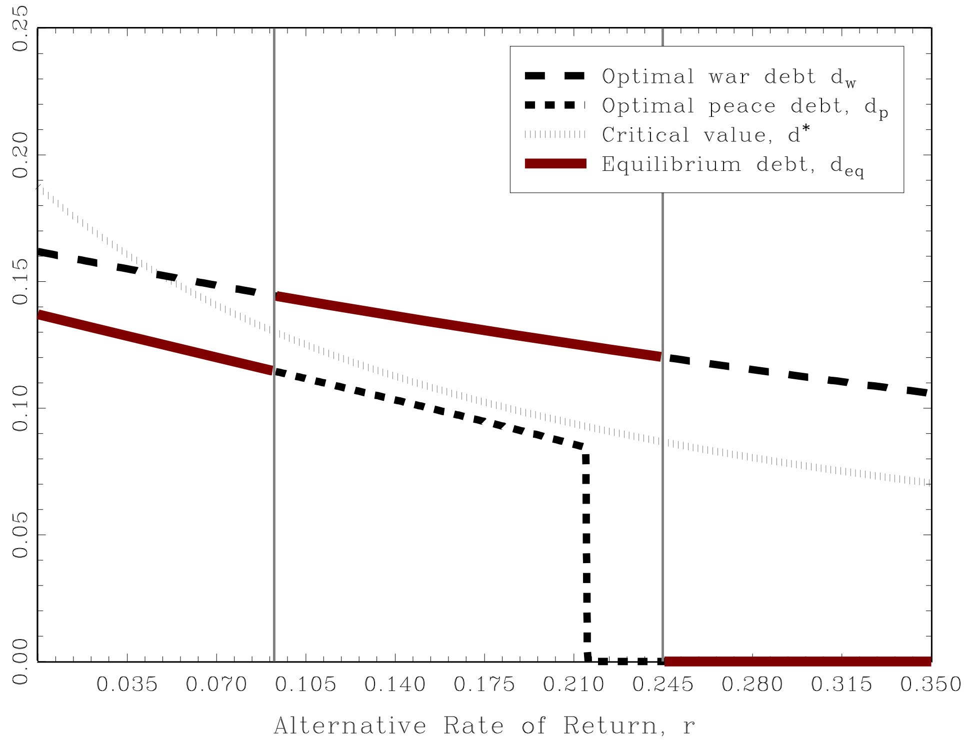


Figure 4: Rate of Return and War, $y = 0.05$, $\pi = 0.85$, $\theta = 0.20$.

The first observation is that for high enough $r$, peace would prevail. In this particular scenario, the interaction would end peacefully for any $r > 0.245$, but it is easy to see that this result holds generally because optimal non-zero debt is strictly increasing in $r$, which makes it less useful for player 1. For high-enough value of $r$, the optimal debt would have to be zero, which in turn implies peace. If we associate higher alternative rates of return with economic prosperity, the substantive implication is that

RESULT 11 *If the economy is sufficiently prosperous (so the alternative risk-free rate of return is sufficiently high), then player 1 would not be able to attract lending either for coercion or war finance, and the game would end peacefully.*

It is possible that the relationship is monotonic: if war is the outcome at $r = 0$, then war would be the outcome until the rate becomes sufficiently high, at which point peace would prevail. Unfortunately, this does not mean that if peace is the outcome at $r = 0$, then the game would always end peacefully regardless of the alternative rate of return. Figure 4 illustrates this: peace is the outcome for $r < 0.092$ and $r > 0.245$, but war is the outcome for values in between. For this level of mobilization efficiency, lack of prosperity (if we associate it with lower alternative rates of return) also results in peace. Only if the rate is higher (so the economy is relatively affluent) can player 1 attract lending to indulge in war. Why is that?

In this scenario, player 1 is not all that inefficient at mobilizing his resources. If the rate of return is low, borrowing is cheap, and he can augment his forces with a debt that is high enough to make a difference for the deal he can get but yet not so high that it would make player 2 unwilling to make the requisite concession. As the alternative rate increases, player 1 must offer better terms to attract lending, so debt becomes more expensive. The only way player 1 can offer such terms is by lowering the relative risk associated with his debt. Unfortunately, because he is not all that efficient at mobilizing his resources, lowering that risk entails heavier borrowing, which increases the pressure for concessions on player 2. As this pressure increases (faster than player 1's ability to win a war), player 2 eventually finds it preferable to refuse the terms that would guarantee the peace. Because war is now inevitable, player 1 escalates the borrowing which occasions a discontinuous decline in the relative risk, as we have already seen. Of course, as the alternative rate increases, war financing becomes more burdensome until it becomes prohibitively expensive, and player 1 reverts to zero-debt, ensuring the peaceful outcome once again. The interaction of prosperity and mobilization efficiency is complex.

RESULT 12 *If player 1 is moderately efficient, then a low alternative rate of return enables him to borrow for coercion but a moderately high rate of return forces him into borrowing for war. Under these conditions, war is the curse of the somewhat affluent, not the poor or the very rich.*

## 7 Conclusion

The prevailing rationalist approach to explain war between two unitary actors focuses on reasons they might be unable to agree on a distribution of the disputed benefit when war is costlier than peace. Regardless of whether the breakdown occurs because of private information or commitment problems, actors fight even though there are deals that both prefer to war. We have learned a lot from this approach but it does leave us with some questions. For instance, how can we account for cases in which both actors prefer to fight? When the bargaining range is not empty, we can only explain imposed wars and wars of regret. This is mildly troubling for a behavioral framework that explicitly relies on choice. The most straightforward way to explain wars of choice is by examining conditions that might wipe out the bargaining range, leaving war as the only optimal way out for both players. I have offered one such possibility in this article. As usual, I assumed that any peace deal implicitly accounts for what the actors expect to secure by fighting. The distribution of power is determined endogenously by the actors given the resources they have and their mobilization effectiveness. By itself, endogenizing the distribution of power was not sufficient to close to bargaining range because it maintained the fundamental assumption that war is costlier than the peace. I broke this assumption by allowing a player to augment his mobilization capacity through borrowing and by supposing that he can repudiate the debt if he loses the war should one break out. These two features of the model ensure that peace is no longer efficient and that under certain conditions it might be less efficient than war.

When a player is relatively inefficient at mobilizing and when the status quo distribution of resources is too disadvantageous, the peace deal that he would be able to secure is going to be quite unattractive because the distribution of power he can obtain will favor his opponent. The central finding is that under these conditions, the player would borrow heavily to improve that distribution of power. Because of his relative inefficiency at mobilizing, any such improvement requires a massive infusion of resources. Since the player is committed to repaying the debt if the negotiations end peacefully, the large debt he incurs would have to be financed with additional concessions by his opponent. Since the resulting distribution of power has not undermined her expected war payoff sufficiently, the opponent becomes unwilling to grant these concessions. The actors have eliminated the bargaining range and because there is no deal that both prefer to war, peace becomes impossible.

Although I have couched the discussion in terms of crisis bargaining, it should be clear that this model can be applied to intrawar bargaining as well. For the war to end, actors must find mutually acceptable peace terms. If they finance their war effort by borrowing, the logic applies and the actor severely disadvantaged by the distribution of mobilizable resources might borrow so heavily that the continuation of war would become inevitable. The substantive implication is that if the losing side can mobilize additional resources in an ongoing war by borrowing, war termination becomes very unlikely even though the country might appear to be close to defeat.

The approach to explaining war I propose here combines certain features of our usual explanation (e.g., a variety of a commitment problem) and the somewhat less common explanation that relies on the costliness of deterring attacks. Despite these commonalities, however, the fundamental cause of war here is different. Instead of seeking reasons for bargaining failure, it focuses on reasons that make mutually acceptable negotiated deals impossible.

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