Borrowed Power:
Debt Finance and the Resort to Arms

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Abstract. Military expenditure is often funded by debt and war losers often repudiate some or all of their obligations. Since governments tend to repay their debt in peace or victory, negotiated settlements become inefficient and can affect crisis bargaining and war termination. I analyze a complete-information model in which players can determine the distribution of power through their military allocations before attempting to reach a peaceful bargain. I show that players might borrow to improve their military capabilities even when doing so will make it impossible to settle the dispute without fighting. This new explanation for war is not driven by commitment problems or informational asymmetries but by the inefficiency of peace imposed by the need to repay the debt. War is the result of actions that eliminate the bargaining range rather than inability to locate mutually acceptable deals in that range, as the traditional explanation has it.

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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 will compensate them for the risk of default. As the military situation worsens, the government's ability to procure funds to continue the war deteriorates 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 and his opponent. 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 Paying for Military Power

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.

1.1 Reserves and Revenue

There have been very few governments that could go to war on an existing "war chest," as 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) or as both belligerents did during the Seven Weeks War in 1866 (Clark, 2006, 536). These reserves, such as they are, get rapidly depleted, usually much faster than the governments imagine they would. 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), military enterprisers like Wallenstein nearly perfected the system to the point that it came to resemble regular tax collection. The French also resorted to this system when they marched and subsisted on the locals in Germany, both under Louis XIV and Napoleon. However, this funding method is politically explosive (because it makes 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 cannot provide even a fraction of the funds expected), and subversive of military strategy (because often effort has to be directed to securing areas for contributions rather than toward victory).[1]

The Nazis have become the epitome of rapacious plunder and exploitation of slave labor in 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 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%

[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.

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 achieve substantial reductions in the domestic costs of war. The 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. They paid Frederick the Great an annual subsidy of £670,000 during the Seven Years War and funded numerous coalitions during the Napoleonic Wars, when (helped by the introduction of the income tax) they spent £30 million just between 1812 and 1815. 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 latter, the French loans amounted to $6.4 million, and the subsidies to $2 million, so the grant was substantial.[3]

Foreign subsidies can be an important source of financial support during war, but they 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 is resented because it can be used to rein in the recipient. The more dependent he is on the subsidy, the more vulnerable to such pressure. The subsidies are also unreliable because support can 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 are 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.

1.2 Currency Manipulation

Nearly all governments manipulate the money supply during war, either by printing money or debasing the coinage. 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

[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]See H. (1931) on the British subsidies. Bemis (1957, 91—93) on the French.

notes without enough coins to support their redemption, by one count five times after Colbert died.[4] 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.[5]

1.3 Debt: Incidence and Risks

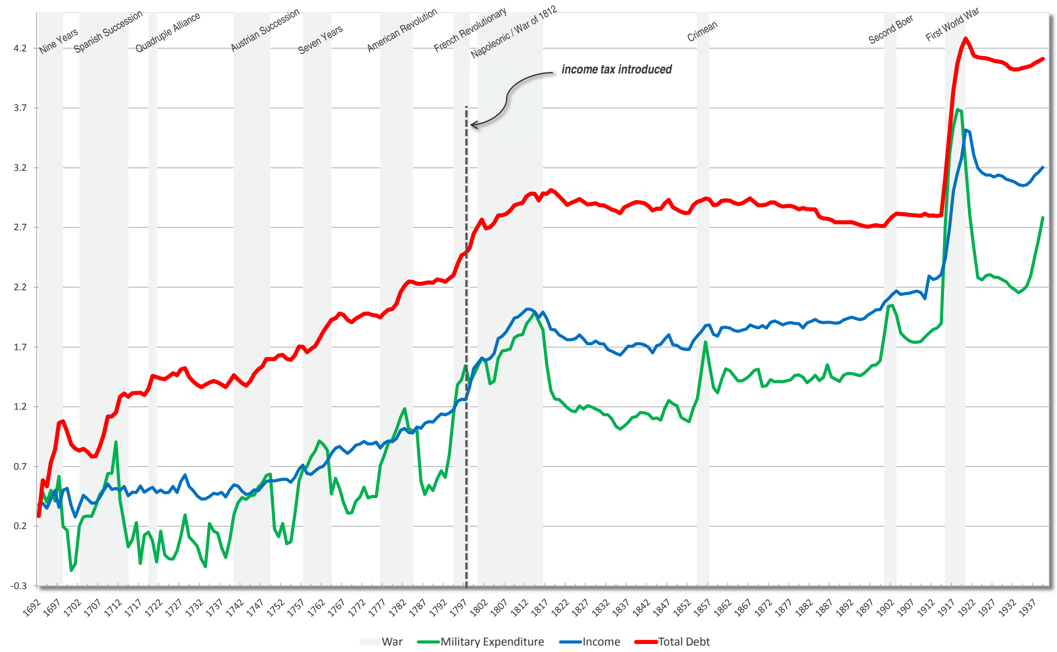


Figure 1: British War Finance, 1692–1939 (log of constant £000,000). *Sources: Mitchell (1962, 386–403), Officer (2009).*

Governments can also fund their military spending by borrowing. The history of British war finance, for instance, is one of perpetual debt ratcheted up by every major war the country got involved in. Figure 1 shows how the regular tax income is often insufficient to handle the exigent demand of war, and how military expenditures are financed by borrowing. The plots are logs of millions of constant (1913) £ sterling. The correction for currency value fluctuation handles inflationary spending, and the use of logged values is necessitated by the dramatic expansion of government economic activities after the Napoleonic Wars. Military expenditures (army and ordnance, navy, expeditionary forces and, after 1920, the Royal Air Force) begin rising in preparation for war and generally continue throughout the fighting. Income (from direct and indirect taxes), on the other hand, tends to remain

[4] 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.

[5] Blanning (1996, 124).

relatively static in the short term and generally cannot cover these expenses. Even the introduction of the income tax (which massively expanded income) did not much alleviate the problem in the 19th century. Although income did outpace military expenditures on several occasions, their combination with increased public spending and debt service charges again put the government in the red during every major war. At any rate, the steady accumulation of public debt (both funded and unfunded) during these major wars shows quite clearly that most of the deficit wartime spending was financed by borrowing. The massive increase of debt during the First World War (from 26% of GDP in 1914 to 128% in 1919) is just part of a long trend.

The ready availability of loans can be explained by the British government's credible commitment to servicing the debt with peacetime taxation after the war (Bordo and White, 1991). Generally, however, the government's ability to rely on borrowing is heavily dependent on its prospects in war and its outcome. For example, during the First World War, the German annual war-related government expenditure averaged 24.4 billion marks between 1914 and 1918. The bulk of the average annual deficit of 25.9 billion marks was funded by debt.[6] 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 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*."[7] Even in Britain the commitment was not absolute because 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

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

[7] 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.

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.[8] When the Franco-Prussian War ended in 1871, the 5 billion franc indemnity owed to the Germans was added to the 16.7 billion existing obligations. The French still carried a substantial debt burden (65% of GDP) when the First World War began. This did not prevent them from running up a breath-taking tab during the war. Even the introduction of an income tax did not prevent the budget deficit from going up to 40% of GDP by the war's end. Although the government inflated some of it away, it was mostly saved by its ability to borrow at relatively low rates.[9] 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).

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. 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 tended to occur only in catastrophic circumstances, of which defeat in war, with its attendant losses of territories and payment of indemnities, was the most severe.[10]

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

[8] 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.

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

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

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 First World War, 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).

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 usher a peculiar dynamic into crisis bargaining, war fighting, and peace negotiations.

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 anything 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.[11]

The answers to this question can be broadly categorized as informational and commitment problems.[12] Despite their widespread acceptance, these mechanisms tend to make a very strong assumption about the distribution of power because almost none of them take into account how actors prepare and maintain the military resources that they would use in crisis bargaining or war. Even dynamic models that admit 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.[13]

[11] 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.

[12] Powell (1999, Ch. 3) lays out the standard model of the risk-return trade-off mechanism (although see Leventoğlu and Tarar (2008) for an analysis that questions its robustness.) Powell (2006) enumerates shortcomings of the informational story and provides a unifying treatment of the existing complete-information mechanisms.

[13] 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 bargaining. Slantchev (2010) investigates the effect of war-fighting allocation decisions on crisis bargaining under

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. 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 each controls mobilizable resources $y_i \in (0, 1)$. Since the main results obtain when there are serious asymmetries in these resource endowments, I assume that the resource distribution is parameterized by player 1's share: $(y, 1 - y)$, with $y = y_1$. This allows me to conduct comparative statics on the degree of asymmetry by changing only one variable.

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 resource constraints. Player 1's marginal cost of mobilization is $\theta > 0$, with player 2's cost the numéraire and set to 1. The forces mobilized, $m_1(d) \leq (y + d)/\theta$ and $m_2(d) \leq 1 - y$, 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.

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 (I will relax this assumption in the final section). 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.

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.

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 do not consider the opportunity costs of arming because the mobilizable resources cannot be used for non-military consumption. The benefit of this assumption is that optimal arming choices occur at the resource constraints, which admits easy-to-interpret closed form solutions. The fundamental results do not change if we introduce opportunity costs but even without this caveat the simplifying assumption is not too wild: up until the end of the 19th century, the primary government expenditure was on war, not the provision of public goods or other consumable benefits. With a potential war looming on the horizon, rulers would raid their resource base in a mobilization frenzy that would leave no source of revenue untapped to its fullest.

Observe further that there is no exogenous constraint on the supply of debt: player 1 is assumed to be able to borrow as much as he might wish. The absence of a fixed ceiling is easily motivated historically: there is always money to be borrowed provided one can meet the terms of the lenders. As we shall see, however, there is an *endogenous* limit to how much player 1 would be willing to borrow. In the interest-free case, he will not borrow more than what he expects to gain in case of victory. He is even more severely circumscribed when he also has to lure lenders with attractive interest rates.

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. Note that any deal in the bargaining range yields both players better payoffs compared to war. Under our assumptions, 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

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. As shown in the formal appendix, the size of the debt is endogenously limited to the size of the post-war benefit, $d \in [0, \pi)$ (Lemma 3), and in any subgame-perfect equilibrium (SPE) players mobilize at their maximum allocations $\overline{m}_1(d) = (y + d)/\theta$ and $\overline{m}_2 = 1 - y$ (Lemma 4). That is, the optimal mobilization choices are equivalent to maximizing the war payoffs, and are at the maximum permitted by the resource constraints. This result 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 results 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 1. *The game will end in war if, and only if, $\theta > \theta_n$ and $d > d^*$, where*

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

□

War occurs in SPE whenever player 1 finds it optimal to borrow at a magnitude that satisfies the conditions identified in Lemma 1, or, more precisely:

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.*

□

Proof. An immediate corollary to Lemma 1 is that player 1 will choose the optimal peace debt $d_p \geq 0$ whenever $\theta \leq \theta_n$ or $d_w \leq d^*$. It is not difficult to see why this obtains. If $\theta \leq \theta_n$, then by Lemma 1 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. ∎

5 Comparative Statics

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. All proofs are in the appendix.

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.*

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.*

Recall from the proof of Proposition 1 that there are two conditions, each of which is sufficient for peace. The claim follows directly from these.

5.2 Mobilization Efficiency

It is straightforward to show that 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.*

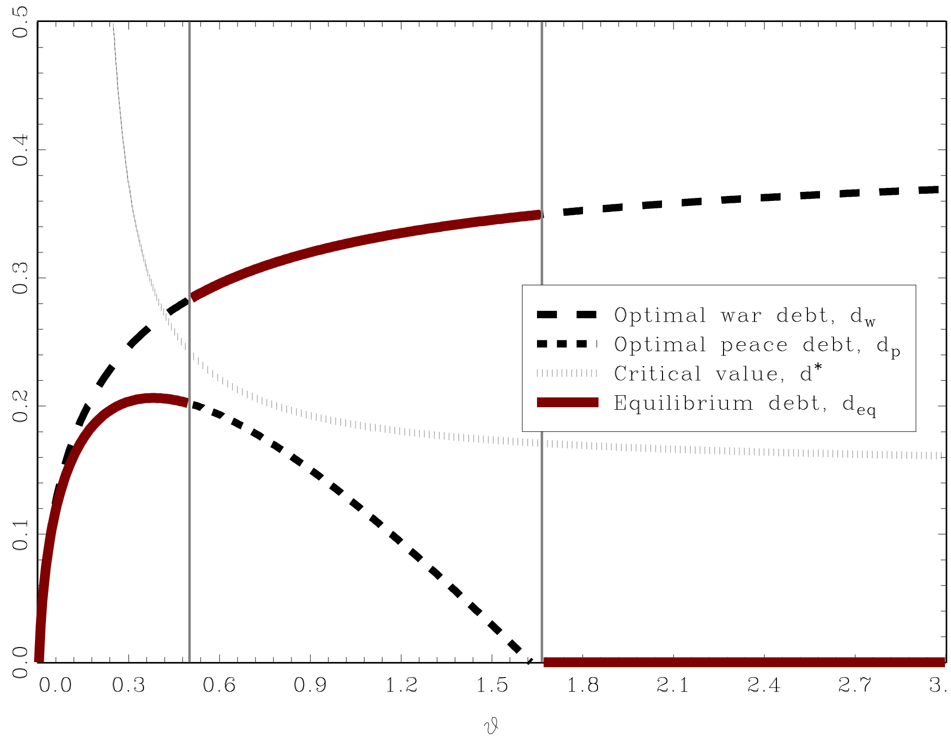


Figure 2: Mobilization Efficiency and War, $y = 0.05, \pi = 0.85$.

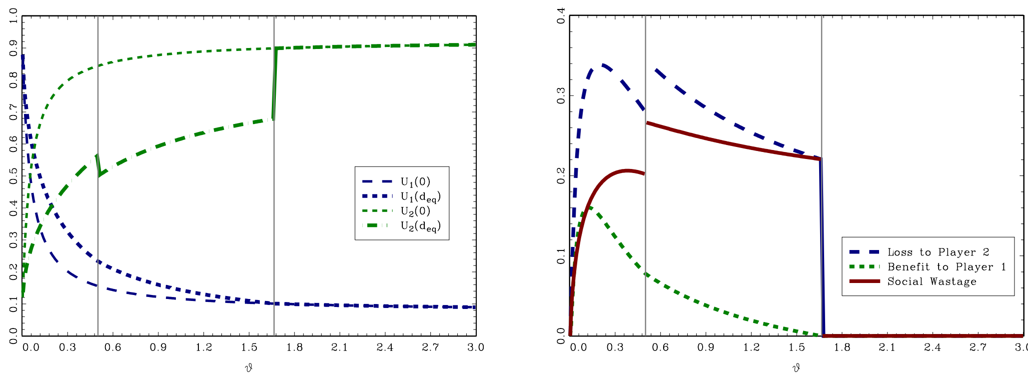
Why do both high efficiency and low efficiency promote peace? Consider a situation, such as Figure 2, in which war occurs for $\theta \in (0.50, 1.67)$. When player 1 is relatively efficient at converting resources to military capability (i.e., $\theta < 0.50$), the distribution of power, $\overline{p}$, 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 capability (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.

It is difficult to say how the debt varies in mobilization efficiency in general (Figure 2 shows it is both discontinuous and might be non-linear even in the high-efficiency region of peace).

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 3(a) shows the equilibrium payoffs for the two players under both scenarios (the parameters are the same as in Figure 2). Figure 3(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).



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

Figure 3: The Benefits and Losses of Debt Financing, $y = 0.05, \pi = 0.85$.

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 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%.

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 2), 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.

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.

6 Theoretical Implications

6.1 The Inefficient Peace

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 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 4 *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.

6.2 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, in which case the bargaining range will never be empty Powell's (2006, 179-80). This creates a puzzle: why would players opt to use such an inefficient mechanism rather than any of the others? On common answer is that war 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 5 *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 natural concern about this approach is that the inefficiencies introduced by borrowing should give players strong incentives to avoid them. Thus, we can treat the model as a continuation game and ask whether players would prefer to settle *before* they enter the borrowing and arming phases. In other words, we can ask Fearon's (1995) question at the stage prior to these decisions. If we are willing to assume that peace can be costlessly maintained, then the original puzzle will reappear. Entering the continuation game is costly for any positive level of debt irrespective of whether it ends in war or peace. This implies that the expected payoffs would sum to less than the size of the benefit, ensuring the existence of the bargaining range. If the mechanism is to explain anything, it must be the case that players somehow "activate" it by forsaking a peaceful solution and entering the continuation game where debt, and possibly fighting, can occur.

I now show that it is quite possible for players to activate the mechanism despite its inefficiencies. One possible reason is the familiar problem of incomplete information, this time arising from player 1's mobilization efficiency. Suppose he can be of two types: moderately efficient, θ_s, and quite inefficient. $\theta_w > \theta_s$. To simplify the derivation, suppose θ_s is such that the continuation game will end in positive debt and war, and that θ_w is such that it will end with zero debt and peace. If players have complete information, then they will coordinate on a mutually acceptable deal that would avoid the continuation game altogether. Without debt, the continuation game itself will be efficient, so $U_1(\theta_w) + U_2(\theta_w) = 1$. Fighting, of course, makes it inefficient: $U_1(\theta_s) + U_2(\theta_s) < 1$.[14] The first continuation game uniquely determines the peace terms, and the second opens up a bargaining range in the usual manner.

Suppose now that player 1 knows his type but player 2 believes that he is moderately efficient with probability $q \in (0, 1)$ and inefficient with probability $1-q$. Player 2's expected continuation payoff given these beliefs is $qU_2(\theta_w) + (1-q)U_2(\theta_s)$. Since the maximum concession a moderately efficient opponent would make is $1 - U_1(\theta_s)$, no peaceful redistribution would be possible with such an opponent whenever player 2 is too optimistic:

$$q > \frac{1 - U_1(\theta_s) - U_2(\theta_s)}{U_2(\theta_w) - U_2(\theta_s)},$$

where we note that $U_2(\theta_w) > U_2(\theta_s)$ from our assumptions. This creates the familiar problem: the strong (moderately efficient) type of player 1 must convince player 2 to offer a better deal but the only way to do this is by mobilizing. Since mobilization requires payment, the debt must be incurred (and therefore repaid), and because he is not all that efficient, he must borrow at level that is not sustainable in peace. The mechanism "kicks in" and the interaction ends in war.

On the surface, it appears as if the "cause" of war here is asymmetric information. However, the underlying mechanism is very different: asymmetric information forces players into a confrontation where one of them engages in behavior that wipes out the bargaining range. The weak would capitulate without debt but the moderately efficient would borrow and fight. In contrast to our traditional explanations, when war begins here neither player can be satisfied with what the opponent is willing to offer.

7 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

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

[14] For instance, with $y = 0.05$ and $\pi = 0.85$ we can use $\theta_s = 1.65$ and $\theta_w = 2.65$. Then we have $U_1(\theta_w) \approx 0.0916$, $U_2(\theta_w) \approx 0.9084$, $U_1(\theta_s) \approx 0.1017$, and $U_2(\theta_s) \approx 0.6775$.

where $D(d)$ is the debt-servicing schedule that player 1 is committed to. 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.

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 3 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 4 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. We can now establish the necessary and sufficient conditions for war:

LEMMA 2. *The game will end in war if, and only if,* $\theta > \theta_n/(1+r)$ *and* $d > \widetilde{d}^*$*, where*

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

□

The optimal war debt can be found by maximizing $W_1(d)$ under the assumption that (4) holds and $\overline{p}(d)$ obtains. The FOC $\pi \frac{\partial \overline{p}}{\partial d} = 1 + r$ defines a quadratic, whose positive root is the optimal war debt:

$$\widetilde{d}_w = \max\left\{0, \sqrt{\frac{\pi\theta(1-y)}{1+r}} - [y + \theta(1-y)]\right\}. \tag{5}$$

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. ■

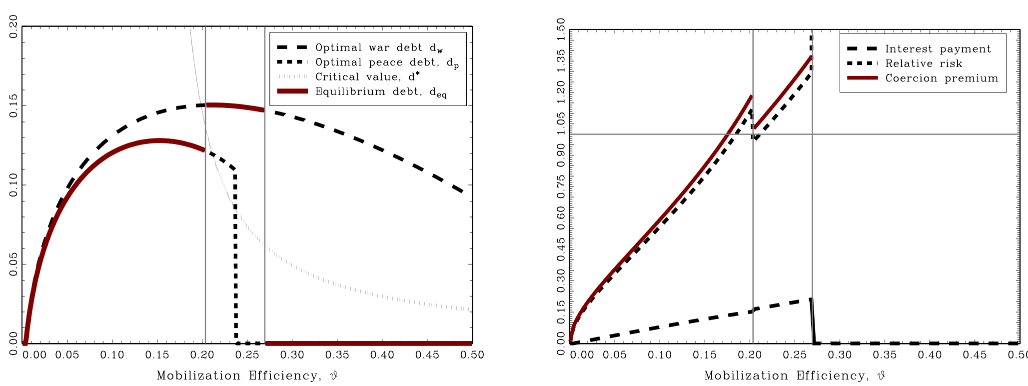
The optimal peace debt does not have a tractable closed form, but it is not difficult to show that it is decreasing in r, just like the optimal war debt.

7.1 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 2 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 4: Mobilization Efficiency, Debt Service, and War, $y = 0.05, \pi = 0.85, r = 0.06$.

Figure 4(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 4(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 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 6 *Increasing mobilization inefficiency increases the coercive premium and the interest payments even though the amount borrowed may decline.*

Figure 4(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 7 *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.

8 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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Formal Appendix

LEMMA 3. *In any subgame perfect equilibrium, $d \in [0, \pi)$.* □

Proof. (W) implies that any SPE with $d = 0$ must end in negotiations. Since $x^*(0)$ is strictly increasing (decreasing) in m_1 (m_2), players mobilize $\overline{m}_i(0)$, yielding the SPE payoff $P_1(0) = p(\overline{m}_1(0), \overline{m}_2)\pi + (1-\pi)/2 > 0$. For any $d > 0$ to be sustainable in SPE, it must be that $P_1(d) \geq P_1(0)$. The best peace deal is $\overline{x} = (1+\pi)/2$, and $\overline{x} - d \geq P_1(0)$ cannot hold for any $d \geq \pi$. Since such values also make the war payoff $p(d)(\pi - d) \leq 0 < P_1(0)$, it must be that $d < \pi$ in any SPE. ■

LEMMA 4. *In equilibrium, players mobilize at the unconditional maxima, $\overline{m}_1(d) = (y+d)/\theta$ and $\overline{m}_2 = 1 - y$.* □

Proof. By Lemma 3, 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. Consider first player 1's allocation. If $d \leq 1 - \pi$, then (W) can never be satisfied, the outcome must be peace, and, player 1 would maximize $P_1(d)$ by choosing $\overline{m}_1(d)$. If $d > 1 - \pi$, then there exists $\hat{m}_1$ such that $\hat{W}_1(d) + d = 1 - \hat{W}_2(d)$, or $\hat{P}_1(d) = \hat{W}_1(d)$. The outcome is war for any $m_1 < \hat{m}_1$, and peace otherwise. If $\overline{m} < \hat{m}_1$, war cannot be avoided, and player 1 maximizes his war payoff with $\overline{m}1(d)$. If $\overline{m} \geq \hat{m}_1$, then $P_1(m) > W_1(m)$ for any $m > \hat{m}_1$ means that he will maximize his peace payoff, which he does with $\overline{m}_1(d)$. The proof for player 2 is analogous. ■

Proof of Lemma 1. At $\overline{p}(d)$, (W) is $[\theta(1-y) - (1-\pi)]\, d > (1-\pi)\,[y + \theta(1-y)]$. 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 $d > d^*$. ■

Proof of Lemma 2. At $\overline{p}(d)$, (WD) is $d(1-\zeta) > y\zeta$, where $\zeta = (1-\pi)/[\theta(1-y)(1+r)] > 0$. A necessary condition for war is $\zeta < 1$, or $\theta > \theta_n/(1+r)$. If this inequality is satisfied, solving the condition for d yields the value of $\widetilde{d}^*$ specified in the lemma. ■

Proof of Result 1. When the costs of war become very small, $\pi \to 1$, and player 1's pre-debt resource base becomes negligible, $y \to 0$, we obtain:

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

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

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 $d^* = 0$, so the second sufficient condition for war in Proposition 1 obtains. ∎

Proof of Result 3. Recall that when $\theta \leq \theta_n$, peace must always prevail. Consider now some $\theta_n < \theta$. Since $\lim_{\theta \to \theta_n^+} d_w = \sqrt{(1-\pi)(1+y)} - y - (1-\pi) < \lim_{\theta \to \theta_n^+} d^* = +\infty$, peace will also prevail for θ greater than, but sufficiently close to, θ_n. Since

$$\frac{\partial d^*}{\partial \theta} = -\frac{(1-\pi)(1-y)(1-\pi+y)}{[\theta(1-y)-(1-\pi)]^2} < 0$$

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

it follows that as θ increases further, there exists θ_c such that $d^*(\theta_c) = d_w(\theta_c)$. For $\theta_c < \theta$, both necessary conditions for war are satisfied, and by Proposition 1 war can occur either because $d^* < d_p$ or because $P_1(d_p) < W_1(d_w)$. Note that

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

Since $d^*(\theta)$ is bounded away from zero and $d_p(\theta) = 0$ for sufficiently high θ, this implies that $d^*(\theta)$ and $d_p(\theta)$ 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 θ. If they do intersect, then war must occur for any values where $d^* < d_p$ but then peace must prevail at θ sufficiently high. This is because $W_1(d_w)$ is decreasing in θ, 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 θ. ∎