State Capacity and Military Conflict[*]

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15-04-2012

Abstract

In 1500, Europe was composed of hundreds of statelets and principalities, with weak central authority, no monopoly over the legitimate use of violence, and multiple, overlapping levels of jurisdiction. By 1800, Europe had consolidated into a handful of powerful, centralized nation states. We build a model that simultaneously explains both the emergence of capable states and growing divergence between European powers. In our model, the impact of war on the European state system depends on: i) the capital intensity of war (which stands for the financial cost of war), and ii) a country's initial level of domestic political fragmentation. We emphasize the role of the "Military Revolution", which raised the cost of war. Initially, this caused more internally cohesive states to invest in state capacity, while other (more divided) states rationally dropped out of the competition. This led to both increasing divergence between European states, and greater average state building on the continent overall.

1 Introduction

Capable states cannot be taken for granted. A new research program on state capacity argues that creating an effective tax system is a costly investment with uncertain return (Besley and Persson 2011). States with a centralized bureaucracy, controlling a significant share of national output, are a recent innovation. For most of mankind's history, there was no highly centralized apparatus that could assert a monopoly of violence, collecting vast revenues, administering justice, and employing huge numbers of civil servants and armed men. Most scholars agree that states as we know them

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today begin to appear after 1500 in Europe. Then, the continent was divided into more than 500 "states, would-be states, statelets, and state-like organizations" (Tilly 1990). Rulers possessed limited tax powers; there was no professional bureaucracy; hiring mercenaries was the main way to obtain armed force; and powerful elites were often above the law. And yet, within three short centuries European powers managed to pull ahead of the rest of the world.

The leading explanation for this development emphasizes the role of warfare. As Charles Tilly (1990) argued, "states made war, and war made states". War gave monarchs the incentive to create an effective fiscal infrastructure – in a belligerent environment, the ability to finance war is key to survival. Besley and Persson (2009) build a model of the government's decision to invest in fiscal capacity. They find that such investment is more pronounced when a common interest (rather than a distributive) public good has to be financed. This model thus links war and state capacity when warmaking is perceived as a common interest public good.

This perspective helps to explain the coexistence of frequent warfare and growing state capacity in some European states after 1600. At the same time, four important issues remain. First, warfare is not unique to either Europe or the early modern period. States mostly failed to develop much before 1600 despite frequent warfare, contradicting the view that war will necessarily translate into state building. For example, hunter-gatherer communities registered high rates of violent death (Clark 2007), but did not engage in state building on any significant scale. Why do modern states emerge in a small corner of the Eurasian landmass after 1500? Second, the growth in state capacity was highly uneven, with some powers such as Britain or France building stronger and bigger states, others such as Spain or Austria falling behind, and some, like Poland, disappearing altogether. If war boosted state building in some countries, it must have had a smaller (or even the opposite effect) in others. Currently, the literature on state capacity is silent on growing divergence in the cross-section. Third, warfare during the period of initial state building (1500-1800) was rarely a common-interest public good. Instead, the "sport of kings" was often a private good for princes in pursuit of glory and personal power, with financing often met with heavy resistance by domestic taxpayers. Fourth, and crucially, wars are not exogenous events. Instead, rulers deliberately decide to go to war. They do so partly in response to a country's existing ability to wage the war successfully. Thus, having a strong state may be the cause, and not the consequence, of war.

This paper addresses these issues by building a model of military conflict and state building. In the model, which is presented in Section 2, two contending rulers choose the centralization of their tax system by taking the prospect of military conflict into account. Centralization is our measure

of state capacity, and captures the extent to which the ruler - as opposed to local power holders - controls taxes and their collection. Military conflict is a costly mechanism financed with taxes that redistributes future fiscal revenues from the losing ruler to the winning one. In this setup, a greater centralizing impetus: i) allows a ruler to collect more fiscal revenues (and win wars more often), but it also ii) requires the ruler to spend resources to sideline domestic power holders, who lose under centralization. In this sense, state building entails a domestic political cost. We first study this tradeoff in the simplest case where war is an exogenous event. Section 5 considers the case where, after having centralized, each ruler chooses whether or not to go to war.

Sections 3 and 4 study the model, showing that the impact of war on state building depends on two aspects. The first one is the financial cost of war. When the creation of an effective military apparatus depends on large financial investments, the ability to raise fiscal revenues is a key strategic asset. The second parameter is the relative political fragmentation of war contenders. Ceteris paribus, state building will be more costly for the rulers of internally divided states.

When the cost of war is low we find that - contrary to Tilly's hypothesis - the presence of military conflict dampens state building compared to a peaceful world. The intuition is that in this case both contenders are similarly likely to win the war regardless of their fiscal revenues. As a result, war only creates the risk for a ruler of losing his fiscal revenues, which reduces his gain from building a more effective tax apparatus. Additionally, given that the odds of victory are even, weak rulers have a relatively larger incentive to go to war against strong ones in a bid to grab the fiscal revenues of the latter. Due to both effects, when war is cheap, frequent warfare and the presence of weak states endogenously reinforce each other.

When instead the "money intensity" of war is high, the possibility of military conflict boosts state capacity in cohesive countries but hinders it in divided countries. This causes strong divergence in state building. Indeed, given the importance of money, the odds of winning the war are stacked in favour of the stronger state. As a result, divided states that find it costly to centralize rationally drop out of the competition – their chances of success are too low. In contrast, cohesive states do not only engage in state building but they also aggressively attack (and conquer) divided ones. Warfare is still frequent, but now it coexists with the consolidation of strong, cohesive states while weak, divided ones gradually lose out.

Historically, the growth of state capacity was often associated with the emergence of institutions limiting the prerogatives of central rulers, particularly with respect to taxation (Dincecco 2009). To shed light on this issue, Section 5 shows that in our model good institutions reduce domestic

opposition to centralization. In our model then, these institutions emerge if a ruler engages in state building but not otherwise. We thus underline the conditions under which the presence of a war threat induces a complementary upgrading of different forms of state effectiveness (Besley and Persson 2011), and when it does not.

In Section 6 we use our model to examine why state-building took off in Europe after 1500. Our model predicts that frequent warfare is not sufficient. For powerful states to emerge, war had to become costly, and internal cohesion of some of the competing powers needed to be relatively high. Our analysis supports the view (Downing 1992) that Europe's political landscape was shaped by the "military revolution", a set of interrelated technological and organizational changes occurring between the 16th and 17th century that made wars more costly and protracted (e.g., Roberts 1956). Before the 16th century the relatively low cost of war may have been responsible for the lack of state building; thereafter, the military revolution created a "race to the top" for those powers starting with low levels of domestic fragmentation, while it stifled the state building of divided countries as their chances of success dwindled. States such as Britain or France succeeded in this highly competitive environment, and came to command resources and centralized administrative control on an impressive scale. Divided and weak states such as Poland failed to do so, and disappeared from the map.

There is a vast literature studying the origins of growth-promoting institutions. Important contributions include Acemoglu (2005), Acemoglu, Johnson and Robinson (2001, 2004, 2005); North (1989); Greif (1993), Delong and Shleifer (1993). This literature does not explicitly consider the role of external conflict, but it sometimes argues that war can overcome domestic agency problems that stand in the way of better institutions (e.g. Acemoglu and Robinson 2006). There is a large literature on the causes of military conflict (see Jackson and Morelli 2011 for a good review). Closer to our work, there is a growing literature studying the institutional factors related to interstate conflict (Martin, Mayer, and Thoenig 2008, Morelli and Jackson 2007, Spolaore and Wacziarg 2010, Yared 2010). A typical question considered is: "Do democracies fight each other less often?" Intra-state conflict is the explicandum, but the institutional features that determine the results are treated as exogenous. Alesina and Spolaore (2005) study how the risk of war affects the size of countries and political alliances between them, while taking each country's institutional structure as given.

We extend these analyses by studying the joint determinants of military conflicts and institutional structure. Of course, since we cannot build a model of everything, we view our paper as

complementing recent work that emphasizes mechanisms we deliberately abstract from. First, we take military technology as exogenous. Hoffman (2011) argues that Europeans refined military technologies like gunpowder more than China (where it was invented) because they had stronger incentives to do so as a result of more frequent warfare. Lagerlöf (2011) analyzes the role of the military revolution in allowing Europe to catch up and overtake China technologically. Our model may help understand Europe's technological lead. By reducing domestic opposition, state building by strong European states could have allowed them to mobilize greater resources relative to their non-European counterparts, facilitating further advances in military technology and thus increases in the cost of war.

In addition, we take domestic political divisions to be exogenous. In actual fact, rulers tried to actively shape the religious, cultural and ethnic composition of their populations through forced conversions, education, and ethnic cleansing. The ruler's centralizing efforts in our model can proxy for some of these activities. On a related vein, De Magalhaes and Giovannoni (2012) study how the threat of external war can reduce domestic opposition, particularly the reluctance of commercial elites to finance an army. For simplicity we abstract from these forces. The main thrust of our analysis still goes through as long as war threats do not resolve domestic rivalries fully, so that preexisting domestic divisions make it more difficult to wage wars, at least initially.

Acemoglu et al. (2011) argue that foreign conquest spread institutional reforms across 19th century Europe. Ticchi and Vindigni (2008) stress the importance of the rise of mass armies for extensions of the franchise (and growing constraints on the executive) in 19th century Europe. Relative to these works, we focus on an earlier period and on domestic reform as a response to foreign threats. The upgrading of institutions by winning powers is however consistent with our approach.

Finally, we relate to the large empirical literature on taxation and the growth of the state in Europe after 1500 (Tilly 1990, Brewer 1988, Bonney). Countries with parliamentary representation typically had higher tax rates than those governed by princes (Hoffman and Norberg 1994, Mathias and O'Brien 1976, Hoffman and Rosenthal 1997). The statistical evidence is analysed inter alia by Dincecco (2009). Stasavage (2003, 2005) analyses coalition formation within countries that may favor the development of public credit. These studies generally show that representative assemblies were better at taxing themselves, as reflected in lower interest rates. Dincecco (2009) also finds that centralization and representation enabled the highest rates of taxation, while the combination of fragmentation and unconstrained rulers was associated with low tax collection. The

arrangements that allowed representative assemblies and the ruler to struck a bargain is explored in Hoffman and Rosenthal (1997). Our work rationalizes these findings but also points out that taxation, institutions and military conflict cannot be separately analyzed because they are jointly endogenously determined.

2   Historical Background and Context

How did Europe after 1500 create the predecessors of modern-day states? The leading explanation emphasizes the role of war and the need to build strong states in a bid for survival (Tilly 1990). Wars were indeed frequent in early modern Europe (table 1). The data collected by Levy (1983) show that in Europe between 1500 to 1700, a Great Power war was underway in 95% of all years (Table 1). Up to 70% of the European population was affected by war at any point in time.

Table 1 here

We argue that this is more of a puzzle than an answer. In Table 1, the frequency of wars was if anything higher in the 16th century than in the 17th centuries, when state consolidation started. Numerous, extended wars were also fought during the medieval period, from the reconquista in Spain to the Hundred Years War between England and France and to innumerable wars between Italian city states. War is also not unique to Europe. China, for example, experienced prolonged conflict during the "warring states period", between 475BC and 221BC (Hui 2005). In neither medieval Europe nor early China did frequent warfare coincide with the creation of highly capable and centralized governance structures.

If we take the number of major battles fought in Europe between the 7th and the 18th century as an indicator of the intensity of warfare, there is a strong upward trend since the early Middle Ages, but there is no major discontinuity in the 16th century that would justify a sudden acceleration of state building [see Figure 1, built from Jacque (2007)].

Figure 1 here

Our answer to the puzzle is that aggressive state building was shaped by a unique synergy between military conflict and changes in the military technology, the so-called "military revolution". Before spelling out this mechanism, this section briefly describes our explanandum – the rise in state capacity in early modern Europe – and our explanatory factor, the military revolution.

2.1 The building of state capacity in Europe after 1500

Two facts are striking about the rise of state capacity in Europe after 1500. One is the sheer magnitude of the increase in state centralization, tax capacity, and military ability over time. The second is the growing degree of divergence between European states.

Figure 2 gives an overview of a simple indicator of state capacity (Besley and Persson 2011) – total tax revenue of the major European powers, in tons of silver per year. We plot change over time, to capture the speed of the increase. All the major European powers for which we have data in 1500 generated combined revenue of 214 tons p.a. Some 280 years later, this had increased by a factor of twenty, to 4,400 tons p.a. Part of the total increase reflected growing population numbers, but an important part reflects higher tax pressure. Measured in grams of silver per head and year, average fiscal revenue increased eight-fold between 1500 and 1780.[1] The second aspect that clearly emerges from Figure 2 is growing difference between European powers. In 1500, Poland's total revenue was half of England's. In 1780, it was equivalent to 5%. Some powers only increased their tax revenue by a small margin, others by a lot. Venetian tax receipts doubled during the course of the early modern period, while those of England surged by a factor of 78.

Figure 2 here

The vast increase in revenue was facilitated by a different administrative structure. Medieval rulers had largely been expected to 'live on their own', i.e. to finance themselves from their domain income (Landers 2003). After 1500, this became impossible. To raise large amounts of tax, states needed to centralize and bureaucratize their administration. Overall, states by the late 18th century had succeeded in this task. By 1780, Britain had centralized collection of excise and customs taxes, and was about to introduce the first successful income tax in history. France, on the other hand, still used tax farming for both direct and indirect taxes. There, vast tax exemptions for the nobility and the clergy hamstrung the monarchy's attempts to raise revenue.

Changes in tax collection were part of a broader pattern of administrative reforms. Ancient legal privileges in many composite states were being reduced. At the same time, the pace at which states succeeded in pushing through administrative and political reforms varied greatly. Spain, for example, had scant success in reducing the fragmentation of its internal market; reforms in Poland foundered on the unanimity principle in the sejm, the assembly of nobles.

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[1]The value of silver declined, but only gradually. The real increase was still by a factor of more than 3.

Armies were, on the whole, no longer provided by mercenary entrepreneurs, as they had been at the beginning of the period. Instead, they were centrally and uniformly equipped from state arsenals, and officered by professional soldiers receiving a regular salary. Military capacity also grew over time, but diverged sharply. By 1780, European armies (excluding Russia and the Ottoman Empire) had more than a million men under arms. The equivalent figure for 1550 was only 300,000. Figure 3 puts these changes in long-term perspective. Compared to the armies of Rome and Byzantium, early modern armies were large (measured as percentage of the population under arms). Indeed, Sweden in 1700 already reached levels of mobilization similar to those in Europe during World War I and II.

Figure 3 here

Some powers succeeded in mobilizing resources more than others (see Table 2 below). At one end of the spectrum, England after 1700 quickly conquered vast parts of the globe. Its armed forces tripled in size between 1550 and 1780. France's army increased by a factor of five, and Austria's, by a factor of 28. In contrast, Poland was partitioned out of existence as a result of military impotence caused by internal strife and fiscal weakness.

Table 2 here

2.2 The "military revolution"

During the early modern period, war became much more costly. Changes in military technology and tactics - referred to by historians as the "Military Revolution" (Roberts 1956; Parker 1996) – resulted in a rise in the financial cost of war. As a result, fiscal attrition rather than battlefield prowess became the main determinant of success in war. As a Spanish 16th century military commander put it, "victory will go to whoever possesses the last *escudo*" (Parker 1996). We do not take a position on the origins of the military revolution, but simply stress that by increasing the importance of money for conducting war, it had an important impact on state building.

Three changes were responsible for the growing importance of fiscal revenue for military success – gunpowder, new fortifications, and the rise of standing armies. The spread of (mobile) cannon after 1400 meant that medieval walls could be destroyed quickly. Fortresses that had withstood

year-long sieges in the Middle Ages could fall within hours.[2] In response, Italian military engineers devised a new type of fortification -- the *trace italienne*. It consisted of large earthen bulwarks, clad with brick, which could withstand cannonfire. These new fortifications were immensely costly to build.[3] The existence of numerous strongpoints meant that wars often dragged on even longer – winning a battle was no longer enough to control a territory. Roger Boyle, the British soldier and statesman observed in the 1670s (Parker 1996):

> Battells do not now decide national quarrels, and expose countries to the pillage of conquerors, as formerly. For we make war more like foxes, more than lyons; and you will have 20 sieges for one battell.

The introduction of standing armies is the third main element of the "military revolution" (Roberts 1956; Parker 1996). Due to the needs for firearms training, states began to organize, equip, and drill soldiers, investing in their human capital. Starting with William of Nassau's reforms during the Dutch rebellion, soldiers were garrisoned and trained continuously.

At the same time, states began to organize permanent navies. While the English had beaten the Spanish Armada in 1588 with an assortment of refitted merchant vessels, navies now became highly professionalized, with large numbers of warships kept in readiness for the next conflict. Investments in naval dockyards, victualling yards, and ships were costly. Even smaller ships in the English navy of the 18th century cost more than the largest industrial companies had in capital (Brewer 1988).

Fortifications, artillery, and ever-larger, better-equipped, and professional standing armies and navies made war an increasingly costly pursuit. The expenses of medieval campaigns had often been met by requisitioning and through the feudal service obligations of medieval knights. After 1500, the business of war was increasingly transacted in cash and credit, and not in feudal dues.[4] The late Middle Ages and the early modern period saw the increasing use of debt financing. During wartime, 80% and more of government expenditure would regularly be devoted to military costs. Military spending could exceed the sum of all tax revenues in a single year – by 50% in some extreme cases, such as Habsburg Spain during the 1570s (Bean 1973).

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[2] The Neapolitan fortress of Monte San Giovanni had withstood medieval sieges for up to seven years; Charles VIII's artillery breached its walls in a matter of hours (Duffy 1996).

[3] The fortress of Besancon was so expensive that when informed of the total cost, Louis XIV asked if the walls had been made of gold (Parker 1996).

[4] Landers (2003). Some have argued that the true increase in the cost of war after 1500 was correspondingly less (Thompson 1995). This is unlikely – indirect social costs probably grew in line with war frequency and army size.

3 The Basic Model

We now present a model shedding light on the link between state building and the military revolution. Sections 2.1 and 2.2 illustrate the role of centralization. Sections 2.3 describes the tradeoff faced by a ruler in deciding whether to centralize or not when there is no external war threat. Section 2.4 introduces an external war threat.

3.1 Production

There are three dates $t = 0, 1, 2$. A country consists of a measure 1 of identical districts, each of which is inhabited by a density 1 of agents who are risk neutral and do not discount the future. They obtain utility by consuming the only (perishable) good produced in the economy. In each period, an agent can undertake either local (l) or market (m) production. Local production yields output A_l and occurs in an agent's own district. Market production is more profitable but requires an agent to carry out some steps of the production process (e.g. input purchases) in a neighboring district.[5] If agent j undertakes market production, he obtains $A_m > A_l$. Agents may also engage in home production (h), the least profitable activity ($A_h < A_l$). If a share n_x of agents undertakes activity $x = l, m, h$, where $n_m + n_l + n_h = 1$, the country's total output is equal to:

$$Y = n_m A_m + n_l A_l + n_h A_h. \tag{1}$$

Output is maximized when all agents engage in market production (i.e. $n_m = 1$).

3.2 State Building, Taxation and Output

A self-interested ruler finances his expenditures using his domain income $D > 0$ and taxes. There are no financial markets.[6] The ruler can tax local and market production. Home production cannot be taxed. Taxation depends on the degree of centralization.

Consider first a fully *centralized* country. The ruler sets country-wide taxes (τ_l, τ_m) where τ_x is the tax on activity $x = l, m$. Since market production yields greater surplus than local production, the optimal tax rates (τ_l^*, τ_m^*) is set so as to: i) discourage local and home production, and ii) extract the full surplus of market over home production. This is attained by setting:

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[5] We assume that districts $i \in [0, 1]$ are located around a circle and that market production is spatially ordered: each agent undertaking market production in a district i must carry out one step of production in the immediately left-adjacent district. This assumption simplifies the analysis of taxation under partial centralization.

[6] Our results go through if the ruler can borrow/lend in financial markets provided these are imperfect enough.

$$\tau_l^* \geq \frac{A_l - A_h}{A_l}, \quad \tau_m^* = \frac{A_m - A_h}{A_m}, \tag{2}$$

so that the ruler's revenue is equal to $A_m - A_h$. That is, everybody chooses to produce for the market (i.e., $n_m = 1$) and the ruler extracts the full surplus so created.

Consider the opposite benchmark of a fully *decentralized* country. The administration of each district i is delegated to a local power holder (e.g., a nobleman) who sets taxes $(\tau_{l,i}, \tau_{m,i})$ on local and market production. There are two key differences with respect to centralization. First, market production initiated in district i is now taxed also in the other district i' where it occurs (see footnote 5). As a result, the total tax rate levied on a producer operating in districts i and i' is equal to $(\tau_{m,i} + \tau_{m,i'})$ and the producer's net income is $(1 - \tau_{m,i} - \tau_{m,i'})A_m$. Second, control over taxation allows each power holder to grab a share of tax revenues for himself. For simplicity, we assume that under decentralization power holders keep all local tax revenues for themselves. Our results extend to milder assumption on tax appropriation.

The appendix then proves that in a symmetric equilibrium where each power holder non-cooperatively sets optimal taxes $(\tau_{l,d}, \tau_{m,d})$, we have:

Lemma 1 *There always exist symmetric equilibria where all districts set $\tau_{l,d} = (A_l - A_h)/A_l$ and $\tau_{m,d} > 1 - (A_l + A_h)/2A_m$. In these equilibria, everybody engages in local production.*

Decentralized districts over-tax market production. This occurs owing to a lack of coordination among competing power holders: each power holder tries to steal revenue from the others. As a result, taxes on market production are too high and market activity is too low. Production and tax revenues are below the first best.[7]

We take the inefficient equilibria of Lemma 1 as our decentralization benchmark. In such equilibria, production in each district is A_l, each power holder obtains $A_l - A_h$, and the central ruler's revenues are 0. In sum, decentralization reduces the ruler's revenues by reducing output (as $A_l < A_m$) and especially by allowing power holders to grab local taxes. This latter effect is important because it shapes the resistance of power holders to the ruler's centralizing efforts.

Consider now the intermediate case of a country where only a measure $\kappa \in (0, 1]$ of districts

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[7]The logic of Lemma 1 is that, at the equilibrium level of taxes, the ruler of each district prefers to discourage market production (by setting a high tax $\tau_{m,d}$ on it) so as to grab all the surplus created by local production. In principle, there is also an equilibrium where all power holders magically coordinate to set $\tau_{m,d} = (A_m - A_h)/2A_h$, so that output and tax revenues are first best. One can rule out such equilibrium by assuming that the return to market production is heterogenoeus across agents.

are centralized. As the ruler internalizes social surplus across centralized districts, he sets taxes (τ_l^*, τ_m^*) in all of them. The centralized part of the country is equivalent to a fully centralized country consisting of $\kappa < 1$ districts.[8] In each centralized district, output is equal to A_m and tax revenues to $(A_m - A_h)$. By contrast, in the $(1 - \kappa)$ decentralized districts local power holders continue to control and grab tax collection. As in the previous analysis, these power holders overtax market production, each setting the tax rates $(\tau_{l,d}, \tau_{m,d})$ of Lemma 1.

This implies that when only κ districts are centralized total output and the central ruler's total tax revenue are respectively equal to:

$$Y(\kappa) = A_l \cdot (1 - \kappa) + A_m \cdot \kappa, \tag{3}$$

$$R(\kappa) = (A_m - A_h) \cdot \kappa. \tag{4}$$

Output and tax revenues increase in centralization κ. In particular, Equation (4) shows that the ruler's revenue is equal to the surplus generated by each centralized district times the measure of districts that are centralized.

This setup seeks to capture the reality of early modern Europe where, before the formation of strong nation states, tax collection often relied on local representative bodies or noblemen. These operated through a system of fixed-sum payments, regional monopolies and overlapping tax schemes which stifled factor mobility and innovation. In this context, centralizing and streamlining tax collection allowed for less distortionary taxation, which generated additional revenues for the monarch while facilitating the growth of commerce. Here we do not imply that political centralization was necessarily desirable (even economically) in early modern Europe. In fact, some of the reforms leading to administrative centralization may have also led to an undesirable concentration of power in the hands of central rulers.[9] As we show in Section 4, in our model state building is in fact most effective when it occurs in tandem with the creation of checks and balances, limiting central power. Our simple setup seeks to capture the notion that, in the context of the fragmented early modern state, administrative centralization allowed for more efficient forms of taxation, paving the way for

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[8] Formally, this requires the additional assumption that the κ centralized districts form a neighborhood around the ruler's own original district $i = 1/2$. Given the spatial pattern of market production described in footnote 6, all market production occurs within centralized districts and only a zero-measure (negligible) amount of market production occurs between centralized and decentralized districts. We simplify the analysis even further by posing that no economic activity occurs between centralized and decentralized districts. As a result, a partially centralized country can be split into a fully centralized and a fully decentralized region.

[9] Acemoglu, Johnson and Robinson (2005) show that "absolutist" states grew less in early modern Europe; Dincecco (2011) extends their analysis and finds similar negative effects.

the creation of states capable of providing public goods on a large scale.

3.3   State Building and Domestic Conflict

We now endogenize centralization as a function of domestic and external conflicts. At the outset, which we denote $t = 0$, the ruler chooses the measure κ of districts to centralize (initially centralization is zero, i.e. $\kappa_0 = 0$). To do so, he must overcome domestic opposition by local power holders, because under centralization they lose the "control rent" $(A_l - A_h)$. This amounts to a total loss of $2(A_l - A_h)$ over the two remaining periods $t = 1, 2$. Centralization increases total tax collection, potentially creating more rents for both the ruler and power holders. However, at $t = 0$ the ruler cannot commit to compensate power holders for losing control over taxes, creating opposition to centralization. In Section 4, we show how institutions can be viewed as a mechanism alleviating this commitment problem.

To overcome domestic opposition, the ruler needs to spend money. In particular, he can crush the power holder of district i (or buy him off) by spending an amount $\beta_i \cdot 2 \cdot (A_l - A_h)$ of resources. Parameter $\beta_i \geq 0$ proxies for the ability and willingness of power holder i to oppose the ruler, and is distributed across districts according to c.d.f $F(\beta)$, which captures the intensity of domestic conflicts in the country.[10] In countries with greater levels of urbanization or religious/linguistic heterogeneity $F(\beta)$ is concentrated on higher values of β so that domestic conflict is more intense. This admittedly reduced-form formalization of internal conflicts allows us to keep the analysis of external wars tractable.

Given this heterogeneity, the ruler begins to centralize districts with low conflict β and then moves to more hostile districts. The cost of centralizing a measure κ of districts is then equal to:

$$C(\kappa) = 2 \cdot (A_l - A_h) \cdot \int_0^{\beta(\kappa)} \beta dF(\beta), \tag{5}$$

where threshold $\beta(\kappa)$ defines the resistance faced by the ruler in the marginal district, formally fulfilling $F[\beta(\kappa)] = \kappa$. In the remainder we assume:

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[10] Cost $2\beta_i \cdot (A_l - A_h)$ can be microfounded by assuming that power holder i: a) can commit to spend in a revolt against the central ruler up to share z_i of the control rent $2 \cdot (A_l - A_h)$ and that b) this translates into "defensive power" $2d_i \cdot z_i (A_l - A_h)$, where d_i is the productivity of the power holder's defense. By contrast, if the ruler spends an amount I_i, he generates "offensive power" $r_i I_i$, where r_i is the effectiveness of the ruler's repression in district i. Here z_i may caputre the power holder's distaste for the central ruler while d_i/r_i proxies his relative strength. If the party with greater (offensive or defensive) power wins, the central ruler must spend $I_i^* = z_i \cdot (d_i/r_i) \cdot 2 \cdot (A_l - A_h)$ to centralize (either by using the resources in a conflct or by bribing the local power holder, who is assumed to have all the baragining power). By denoting $\beta_i = z_i \cdot (d_i/r_i)$ this microfoundation maps into our model.

A.1: β is uniformly distributed in $[0, B]$.

This assumption implies that Equation (5) takes the convenient form:

$$C(\kappa) = \kappa^2 B \cdot (A_l - A_h).$$ (6)

The cost of reform is convex because marginal districts are increasingly opposed to reform. The cost of reform grows with parameter B, which captures the strength of domestic conflict.

Consider the extent of centralization undertaken at $t = 0$ by the ruler absent any external threat. We call this regime "autarky." At $t = 0$, the ruler sets κ to maximize his utility over $t = 0, 1, 2$. The ruler finances the reform cost out of his domain income $D > 0$, which he receives at $t = 0$. The ruler's consumption at $t = 0$ is thus equal to $D - C(\kappa)$, his consumption at $t = 1$ and $t = 2$ is equal to the fiscal revenues generated in these periods.[11]

It is convenient to view the ruler as choosing the fiscal revenue R that he can collect at $t = 1, 2$ rather than a level of centralization κ. Given Equation (4), revenue R uniquely pins down the underlying level of centralization as $\kappa = R/(A_m - A_h)$. By plugging this expression into (6), we can see that the ruler solves:

$$\arg\max_{R} \; 2R - \frac{B(A_l - A_h)}{(A_m - A_h)^2} \cdot R^2.$$ (7)

The optimal degree of centralization trades off the benefit for the ruler of obtaining fiscal revenues $2R$ over $t = 1, 2$ with the cost of curtailing domestic opposition at $t = 0$. The optimal reform R_{aut} prevailing under autarky is then equal to:

$$R_{aut} = (A_m - A_h) \cdot \min\left[\frac{1}{B}\frac{(A_m - A_h)}{(A_l - A_h)}, 1\right].$$ (8)

If $B(A_l - A_h) \leq (A_m - A_h)$, domestic divisions B or power holders' rents $(A_l - A_h)$ are so low relative to the ruler's revenue gain $(A_m - A_h)$ that the ruler centralizes fully, setting $R_{aut} = (A_m - A_h)$ (and thus $\kappa = 1$). If instead $B(A_l - A_h) > (A_m - A_h)$, domestic opposition is strong enough that the ruler centralizes only partially, setting $R_{aut} < (A_m - A_h)$.

Stronger domestic conflicts (i.e., higher B) reduce the ruler's ability to extend his power into

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[11] We are implicitly assuming that domain income D is only received at $t = 0$ and it is sufficient to pay for the reform cost, i.e. $D > C(1)$. This simplifies the analysis of state building when external war is present. Little would change if the ruler receives D also at $t = 1$ and at $t = 2$. In particular, the marginal impact of centralization on the ruler's fiscal revenues does not change with D.

peripheral areas, stifling state building. By contrast, state building increases when it causes a larger gain in district-level revenue $(A_m - A_h)/(A_l - A_h)$, owing for instance to higher productivity A_m/A_l of market production. The pattern of state formation is shaped by the tension between reaping the benefits from the creation of a national market (proxied by A_m/A_l) and the opposition against central rulers by a myriad of local princes, cities, principalities, and estates (proxied by B).

Before moving on, note that when $B > (A_m - A_h)/(A_l - A_h)$ - which we assume throughout - Equation (8) allows us to rewrite the ruler's cost of centralization in the following intuitive way:

$$C(R) = c \cdot R^2 \quad \text{where} \quad c \equiv \frac{1}{R_{aut}}, \tag{9}$$

with R_{aut} being identified by (8). A higher marginal cost c proxies for more severe domestic divisions B or a lower benefit of centralization $(A_m - A_h)/(A_l - A_h)$. Depending on analytical convenience, we will use c or the (inverse of the) autarky reform level R_{aut} as proxies for the cost of state building.

3.4 External Conflict and Incentives to Reform

There are two-countries, "home" H and "foreign" F. At $t = 1$ they exogenously enter armed conflict with probability θ, where θ captures the belligerence of the environment. If $\theta = 0$, we are back to autarky; if $\theta = 1$, war occurs with certainty. Parameter θ captures factors leading to war that are unrelated to rulers' economic payoffs, such as empire-building motives, religious conflict, dynastic struggles, and inter-ruler rivalry. Here we assume that these exogenous events always trigger war. Section 5.2 allows rulers to endogenously choose whether or not to go to war conditional on the realization of a trigger.

War is costly. It absorbs the fiscal revenues of both rulers while it is fought, and redistributes fiscal revenues from the losing to the winning ruler thereafter.[12] Denote by R_J the fiscal revenues available at $t = 1, 2$ to the ruler of country $J = H, F$. If at $t = 1$ there is a war, each ruler spends R_J to wage it. Thus, greater centralization at $t = 0$ allows the ruler to have more resources to wage the war at $t = 1$. At $t = 2$, then, the winner is "awarded" the fiscal revenues of the two countries $R_H + R_F$. The loser obtains nothing. Due to these assumptions, at $t = 0$ the consumption of ruler

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[12]The assumption that at $t = 1$ the ruler spends all fiscal revenues in the war is realistic. During the war there are few opportunities for the king to spend resources in personal consumption. We have studied the case in which at $t = 1$ rulers optimally choose how much to spend in the war and our main results continue to hold, particularly with the linear contest success function of Section 4.2. The results are available upon request.

J is equal to $D - C_J(R_J)$, where $C_J(R_J)$ is the cost of his reform. If at $t = 1$ war does not arise, this ruler consumes $2R_J$ over $t = 1, 2$, just as in autarky. If instead at $t = 1$ war erupts, the ruler of country J uses his $t = 1$ revenues to wage the war; at $t = 2$ then, he consumes nothing if he loses while he consumes $R_H + R_F$ if he wins.

The war outcome is stochastic. Ruler H wins with probability $p(R_H, R_F)$, ruler F with probability $1 - p(R_H, R_F)$. Function $p(R_H, R_F)$ is thus a contest function of the kind used in the existing theory literature on conflict (see, for example, Dixit 1987, and Skaperdas 1996 for a review). A ruler is more likely to win if his tax revenues are higher, for this allows him to finance a larger or better army. Additionally, a ruler's war spending has decreasing, or not too increasing, marginal returns. This ensures concavity of the ruler's objective function (see the proof of Proposition 1). Formally, the contest success function $p(R_H, R_F)$ is continuous, differentiable and features $p_H > 0$, $p_F < 0$, and $p_{HH} \leq Z$ and $p_{FF} \geq Z$, where p_J and $p_{J,K}$ ($J, K = H, F$) denote the function's first and second derivatives with respect to R_H and R_F and $Z > 0$ is a suitable bound on second derivatives.

The sensitivity of the war outcome to fiscal revenues $|p_J|$ is a key driver of centralization. When $|p_J|$ is high, money is crucial to win the war. To see this, consider a formulation where the military strength of country J takes the Cobb-Douglas form $L_J^\alpha R_J^\lambda$, where L_J is the population of the country. Parameters $\alpha, \lambda \geq 0$ respectively measure the extent to which military might is driven by labor and capital. Holding α constant, a higher λ captures both a greater intensity of war in financial capital, as well as greater returns to scale to the military technology. We view the military revolution as an increase in λ. The introduction of fortifications, gunpowder, portable firearms, and large navies not only made war more costly but it also increased the return of building an effective army.

Suppose then that the probability with which ruler H wins the war increases in his relative military strength with respect to ruler B according to the following expression:

$$p(R_H, R_F) = \frac{L_H^\alpha R_H^\lambda}{L_H^\alpha R_H^\lambda + L_F^\alpha R_F^\lambda}. \tag{10}$$

Then, the sensitivity of war to a country's fiscal revenues is equal to:

$$|p_J| = \lambda \cdot \frac{p(1-p)}{R_J}, \tag{11}$$

which increases, for given (p, R_J), in the money sensitivity of the military technology λ.[13] In the economic literature on contests, λ is called the "decisiveness parameter" and Hirshleifer (1995) associates an increase in such parameter to a breakdown of anarchy. For simplicity, we take the labor inputs (L_H, L_F) to be fixed, but it is easy to see how labor-money complementarity in the military technology can generate a comovement between state building and the rise of mass armies.

While we obtain some results using a general contest function $p(R_H, R_F)$, we will often use Equation (10) as a reference. In particular, to obtain intuitive closed form solutions we employ a linearized version of Equation (10).

The timing of the model is as follows:

Figure 4 here

Given these preliminaries, ruler H chooses (centralization and thus) revenue R_H so as to solve:

$$\max_{R_H} \; \theta \cdot \{p(R_H, R_F)(R_H + R_F) - 2R_H\} + 2R_H - c_H \cdot R_H^2, \tag{12}$$

while ruler F chooses (centralization and thus) revenue R_F so as to solve:

$$\max_{R_F} \; \theta \cdot \{[1 - p(R_H, R_F)](R_H + R_F) - 2R_F\} + 2R_F - c_F \cdot R_F^2. \tag{13}$$

In Equations (12) and (13), the war threat $(\theta > 0)$ affects the benefit of centralization relative to autarky [which is identified by $\theta = 0$] by changing the marginal impact of fiscal revenues on the ruler's utility at $t = 1, 2$. There are two effects. First, war creates the risk for rulers of losing the totality of their fiscal revenues $2R_J$, in financing the war as well as in losing it. This discourages state building. Second, war creates the opportunity for rulers to enjoy $(R_F + R_H)$ in case of victory. This encourages state building.

Under risk neutrality, parameter θ can also be interpreted as the share of revenues (or land) a ruler can lose in the war, capturing the severity of a war threat. For simplicity, in the remainder we stick to the interpretation of θ as the ex-ante probability of war. The marginal cost c_J of

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[13]Equation (10) can be microfounded by assuming that, for given population and revenues, there is a random shock ϵ to the relative military strength of country F, so that country H wins the war provided:

$$L_H^\alpha R_H^\lambda \geq \epsilon L_F^\alpha R_F^\lambda,$$

where the natural logarithm of ϵ follows a logistic distribution with mean 0 and location 1.

centralization does not change with respect to autarky.[14] Crucially, c_J can differ across countries, owing to differences in domestic divisions B_J among contestants (this is in fact the source of heterogeneity that we will focus on) or to differences in the relative efficiency of market production $A_{m,J}/A_{l,J}$. We now study how these forces shape reform.

4 War and State Building

4.1 The Basic Strategic Effects

Equilibrium reforms constitute a Nash equilibrium of the game where rulers choose R_H and R_F according to (12) and (13). When the rulers' objective functions are concave (we focus on parameter ranges where this is the case), an equilibrium is identified by the first order conditions:

$$c_H \cdot R_H = 1 + (\theta/2)\left[p_H(R_H + R_F) - (1-p) - 1\right], \tag{14}$$

for country H, and:

$$c_F \cdot R_F = 1 + (\theta/2)\left[-p_F(R_H + R_F) - p - 1\right], \tag{15}$$

for country F. The war threat ($\theta > 0$) exerts three *direct* effects, which are all included in square brackets in the above equations. First, it boosts the incentive to centralize because, by increasing fiscal revenues, centralization enhances the probability of winning the war. This effect is captured by the first term in square brackets (as $p_H > 0$, and $p_F < 0$). Second, war lowers the benefit of centralization by creating the risk that the extra revenues created by reform are lost in the war. This effect is captured by the second (negative) term in square brackets and reduces the benefit of reform. Finally, the resource cost of war, which absorbs fiscal revenues at $t = 1$, also reduces the ruler's return from centralization. This is the third (negative) term in square brackets. Overall, war boosts a ruler's incentive to centralize when the sum of the terms in square brackets above is positive while dampens it otherwise.

Equations (14) and (15) identify two reaction functions $R_H(R_F | \theta, c_H)$ and $R_F(R_H | \theta, c_F)$ that link state building in the two countries. These reaction functions depend on the severity of the

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[14]This is because in our model external threats do not affect the severity of domestic divisions. There are two reasons for this. First, powerholders are atomistic. Hence, their opposition to centralization does not affect the outcome of war. Second, powerholders are equally "exploited" by the two rulers (as war just rallocates fiscal revenues across the latter), so they see no systematic reason for standing in support or against the incumbent. Of course, in reality conflict may affect domestic opposition, but the systematic analysis of this possibility is beyond the scope of the current paper. See De Magalhaes and Giovannoni (2012) for a model of these effects.

external war threat θ and on a country's cost of reform c_J, where the latter summarizes political as well as economic domestic conditions. An equilibrium (R_H^*, R_F^*) occurs where the two reaction curves intersect. In the appendix we prove:

Proposition 1 *If an interior equilibrium (R_H^*, R_F^*) exists, it is unique. Furthermore:*

a) A more severe war threat (i.e. higher θ) boosts reform incentives in country $J = H, F$ if and only if war is sufficiently sensitive to fiscal revenues, namely:

$$\frac{dR_J(R_{-J}\,|\theta, c_J)}{d\theta} > 0 \quad \text{if and only if } |p_J| \text{ is sufficiently large.} \tag{16}$$

b) A higher marginal cost of reform c_J dampens reform incentives in $J = H, F$, namely:

$$\frac{dR_J(R_{-J}\,|\theta, c_J)}{dc_J} < 0. \tag{17}$$

c) The reaction functions of countries $J = H, F$ and $-J \neq J$ always have opposite slopes, namely:

$$\frac{dR_J(R_{-J}\,|\theta, c_J)}{dR_{-J}} > 0 \quad \text{if and only if} \quad \frac{dR_{-J}(R_J\,|\theta, c_{-J})}{dR_J} < 0. \tag{18}$$

These results stress, for a general contest success function, what factors shape centralization. According to a), the war technology plays a critical role. A more bellicose environment (i.e., a higher θ), boosts a ruler's incentive to reform if and only if the war outcome is highly sensitive to fiscal revenues. This occurs when effective war-making requires large technological and organizational investments. When instead these investments are less important at the margin, a higher probability of war *dampens* a ruler's incentive to centralize. In the latter case, the ruler realizes that - besides having a relatively modest impact on the war outcome - the revenue gain created by state building may be lost in war. This blunts his incentive to centralize.

Property b) says that the incentive to centralize is high when c_J is low. This effects arise also in autarky but here it crucially implies that external war does not automatically transform state building into a common interest public good. Because atomistic power holders do not have a personal interest in centralization, they oppose the latter even if external conflict is possible. As a result, external threats differentially affect state building across countries. By facing a high reform cost c_J, the ruler of a divided country may be unable to respond to external war as much as a more cohesive opponent, reducing the former's incentive to centralize.

Finally, property c) illustrates that strategic effects introduce yet another source of divergence

in state building. The ruler with a positively sloped reaction function reacts to stronger reform abroad by increasing his own reform stance. We call this ruler an "aggressive reformer". The ruler with a negatively sloped reaction function reduces his own reform efforts when reform abroad gets stronger. We call this ruler a "timid reformer". This asymmetry in the rulers' reaction functions is due to the zero-sum nature of war: the ruler that is more effective at war will undermine the other ruler's investment in state building. Thus, when facing a strong contestant a weak ruler "gives up", deliberately moderating his own reform stance. To show this, Figure 5 plots the effect of a drop in the cost of reform in the aggressive reformer H.

<center>**Figure 5 here**</center>

As the cost of reform in H falls, the reaction function of its ruler shifts outward. As a result, not only does H reform more aggressively but, owing to strategic effects, ruler F reduces his reform stance! This implies that the war threat creates *centripetal* forces dampening the effect of domestic conflict in the aggressive reformer and *centrifugal* forces boosting the effect of domestic conflict in the weak reformer. This creates strong divergence in state building across countries.

In the Appendix, we show (see Corollary A) that Proposition 1 pins down the comparative statics of reforms at an interior equilibrium. Intuitively, reform in a country increases as the cost of reform in the same country drops. Furthermore, if the cost of reform drops abroad, reform at home goes up if and only if the home country is the aggressive reformer. To study in detail how the war technology affects state building, we now consider the tractable case of a linear approximation of Equation (10). We study the properties of the power specification in Appendix 2.

4.2 Linear(ized) Contest Success Function

By linearizing (10) around the point in which both countries win with probability $1/2$ we obtain:[15]

$$p(R_H, R_F) = \frac{1}{2} + \lambda(R_H - \gamma R_F), \tag{19}$$

Recall that parameter λ is the money sensitivity of the war outcome. Parameter γ - which captures the relative effectiveness of F at warmaking - is equal to $(L_F/L_H)^{\alpha/\lambda}$. The relative effectiveness of F increases in the country's relative size. Intuitively, since money and labor are

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[15]The revenues $(R_{H,0}, R_{F,0})$ around which (10) is linearized fulfill $L_H^\alpha R_{H,0}^\lambda = L_F^\alpha R_{F,0}^\lambda$, and $R_{H,0}$ is normalized to 1. Focusing on cases in which contestants' military strength is evenly matched allows us to isolate the potential for divergence created by the threat of war

<center>20</center>

complementary in the military technology, the larger is F, the more productive are its investments relative to H. Without loss of generality, we assume that F is less populous than H, namely $\gamma \leq 1$, so that H has a comparative advantage at warmaking.

Denote the autarky revenues in the two countries by $(R_{H,aut}, R_{F,aut})$.[16] We assume that autarky revenues fulfill $\theta\lambda \max\left[R_{H,aut}, \gamma R_{F,aut}\right] < 1$, which ensures that the rulers' objectives are concave. Then, an interior equilibrium occurs at the intersection of the reaction functions:

$$R_H(R_F \,|\, \theta, c_H) = \left(\frac{1 - 3\theta/4}{1 - \theta\lambda/c_H}\right) \cdot R_{H,aut} + \frac{\theta(1-\gamma)\lambda/c_H}{1 - \theta\lambda/c_H} \cdot R_F, \tag{20}$$

$$R_F(R_H \,|\, \theta, c_F) = \left(\frac{1 - 3\theta/4}{1 - \theta\lambda\gamma/c_F}\right) \cdot R_{F,aut} - \frac{\theta(1-\gamma)\lambda/c_F}{1 - \theta\lambda\gamma/c_F} \cdot R_H. \tag{21}$$

The intercept captures the reform chosen by a ruler when his opponent does not reform at all (i.e., when $R_{-J} = 0$), the second term captures a ruler's reaction to state building abroad. Notice that H, the country having a military advantage, is the aggressive reformer because its optimal reform increases with R_F. In contrast, F is the timid reformer because its reform decreases with R_H.

Consider the equilibrium prevailing when H and F are equally sized, namely $L_H = L_F$ so that $\gamma = 1$. In this case, there is no strategic interaction between reforms in different countries. This allows us to isolate the role of properties a) and b) of Proposition 1, abstracting from c). The appendix then proves the following result.

Proposition 2 *Under some technical conditions, if $\gamma = 1$ in equilibrium we have:*

$$R_J^* = \min\left[\frac{1 - 3\theta/4}{1 - \lambda\theta/c_J} R_{J,aut}, \quad A_{m,J} - A_{h,J}\right] \quad \text{for } J = H, F. \tag{22}$$

The equilibrium (R_H^*, R_F^*) displays the following properties:
i) Centralization $\kappa_J^* = R_J^*/R_c$ increases in the importance of money for military success λ for all $J = H, F$. In country J, centralization increases with the frequency of external conflict θ if and only if λ is large relative to the marginal cost of reform, namely provided

$$\lambda > 3 \cdot c_J/4.$$

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[16] Autarky revenues are allowed to differ from the values $(R_{H,0}, R_{F,0})$ around which the reaction function is linearized. We could allow $(R_{H,aut}, R_{F,aut})$ to coincide with $(R_{H,0}, R_{F,0})$, but in such case the analysis should be carried out by taking into account the further restriction $L_H^\alpha R_{H,aut}^\lambda = L_F^\alpha R_{F,aut}^\lambda$.

ii) If centralization is partial in all countries, namely $\kappa_J^* < 1$ for $J = H, F$, we have that:

$$\frac{R_H^*}{R_F^*} = \frac{R_{H,aut}}{R_{F,aut}} \cdot \frac{1 - \lambda\theta/c_F}{1 - \lambda\theta/c_H}, \tag{23}$$

so that $R_H^*/R_F^* > R_{H,aut}/R_{F,aut}$ if and only if $c_H < c_F$.

The extent of centralization κ_J^* pursued by rulers increases with the importance of money for military success λ. If $\lambda < 3 \cdot c_J/4$, state building does not increase the chances of military success much. Here centralization primarily increases the revenues available for consumption, making the country a better prey for its opponent. The prospect of simply becoming a better prey induces the ruler to centralize less than in autarky. If instead $\lambda > 3 \cdot c_J/4$, centralization does not only increase revenues for consumption, it also significantly boost the chances for a country to prey upon its opponent. To become a stronger predator, the the ruler centralizes more than in autarky.

Crucially, result *ii)* shows that the presence of a war threat *amplifies* inequality in state building relative to autarky. If $\theta > 0$, the country where centralization is cheaper (due to lower domestic divisions and/or higher productivity of market production) centralizes disproportionately more than its opponent. The incentive to centralize is particularly strrong in the low-cost country, which is likely to be a predator. By contrast, as the high-cost country perceives a strong risk of becoming a prey, its incentive to centralize is relatively low. These effects become stronger as λ goes up.

To see the link between domestic conflict, external conflict and reform, suppose that countries H and F only differ because domestic divisions B_J are higher in F than in H, i.e. $B_H < B_F$. Denote by R_{aut} the autarky reform $R_{H,aut}$ in country H. The autarky reform in F is then equal to $R_{F,aut} = (B_H/B_F)R_{aut}$. Figure 6 plots the pattern of state building in the two countries.

Figure 6 here

The horizontal axis measures the common component of autarky revenues. A higher R_{aut} can capture a global boost in the efficiency of market production, due to increasing commercialization, which reduces the marginal cost of centralization $c_J = 1/R_{J,aut}$ in all countries. The vertical axis measures the sensitivity of war outcomes to financial strength. When $\lambda < 3/4R_{aut}$, the military gains from increasing fiscal revenue are so low relative to the cost of reform that a race to the bottom prevails: state building declines in all countries. As λ increases above $3/4R_{aut}$, the ruler of the less divided country H can tilt the war outcome in his favour by engaging in state building. In contrast, the ruler of country F will be reluctant to do because he faces strong domestic opposition.

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In this range, the external war threat creates pervasive inequality in state building across countries. As the sensitivity of war to fiscal revenues becomes very large, so that $\lambda > 3/4(B_H/B_F)R_{aut}$, the war threat boosts centralization even in country F. Eventually, as λ increases, both countries centralize fully, i.e. $\kappa_H^* = \kappa_F^* = 1$.

The case where $\gamma = 1$ leaves out the strategic effects of Proposition 1 (property c) and of Corollary 1. To gauge these effects, consider the following result:

Proposition 3 *When $\gamma \leq 1$ equilibrium reforms fulfill:*

$$\frac{R_H^*}{R_F^*} = \frac{R_{H,aut}}{R_{F,aut}} \cdot \frac{1 + \theta\lambda(1-2\gamma)/c_F}{1 - \theta\lambda(2-\gamma)/c_H}. \tag{24}$$

R_H/R_F increases as γ becomes smaller. $R_H/R_F \geq R_{H,aut}/R_{F,aut}$ if and only if $\gamma \leq (c_H + 2c_F)/(2c_H + c_F)$. In this case, R_H/R_F increases in λ.

If country F is not only less cohesive, but also weaker in the battlefield than country H (i.e., $c_F > c_H$ and $\gamma < 1$), then divergence in state building is very strong. Indeed, now the greater reform stance in the cohesive country H directly dampens reform in F via strategic effects. The intuition is that when $\gamma < 1$ the ruler of country F expects to lose the war even if he undertakes an extensive reform, which hinders his incentive to centralize. Conversely, if country F is highly efficient at war-fighting ($\gamma > 1$), it may overcome the shortcoming of having greater internal divisions. The key point of Proposition 3 is that war creates inequality in state building not only via its interaction with domestic conflict but also via a strategic effect due to inequality in the countries' military prowess.

In Appendix 2 we study the model under the contest function of equation (10). The algebra in this case is more involved, but it is still true that external war boosts state building only when the money sensitivity of war λ is high. Accordingly, differences in domestic conflicts trigger divergence in state building across countries.

4.3   Comment

We found that - contrary to conventional wisdom - an external war threat does not necessarily boost state building. For this to be the case, war must absorb large financial resources. Critically, state building may feature a strong divergence, with internally cohesive countries aggressively centralizing and divided countries being reluctant to do so. To visualize these effects, let us go back to Figure

6. We can see that, as political entities consolidate and the world becomes belligerent, three consecutive patterns of state consolidation should occur as a function of the costliness of military technology λ.

In the first phase, the sensitivity of war to fiscal revenues is low relative to the cost of reform, and the risk of entering a war discourages state building in all countries. In this range, the state system is highly fragmented, the balance of power within political entities is unstable, and does not lead to the emergence of a strong centralized power. Increases in the cost of war make rulers more hungry for fiscal revenues. They thus increasingly centralize their power by reducing rent extraction by local magnates and streamlining tax administration. Taxation becomes less distortionary, which may spur growth and commerce. As the tax base expands, so do the stakes involved in warmaking, further boosting state building. That is, increases in λ create a positive feedback mechanism whereby improvements in the efficiency of tax collection reduce tax distortions, foster growth, thereby begetting further state building.

As the cost of war becomes intermediate (relative to the domestic cost of reform), we enter a second phase where strong asymmetries emerge. The monarchs of less divided countries disproportionately centralize while the rulers of less powerful countries drop out of the competition and restrain their state building efforts. Now the international system consists of politically strong and economically developed centralized countries and weaker, poorer, less centralized countries. These laggard countries are unlikely to survive as they increasingly fall prey to the strong ones.

Finally, as the cost of war becomes highest, we enter a third phase where all rulers maximally boost their state building efforts and countries converge to the full centralization benchmark where tax distortions are lowest and productions is highest.

5 Institutions, Centralization and the Decision to Go to War

We now show that the link between state building and the military technology becomes stronger once one accounts for the rulers' decision to create institutional constraints limiting their own prerogatives as well as for their endogenous choice of whether or not to go to war.

5.1 Institutions and Centralization

We view institutions as constraints on the ruler (Acemoglu, Johnson and Robinson 2001), limiting his ability to extract resources from power holders under centralization. Specifically, in country

$J = H, F$ institutions set the share $(1 - \pi_J) \in [0, 1]$ of tax revenues that the ruler can appropriate in a *centralized* district. The remaining share π_J of tax revenue goes to the power holder. As before, fiscal revenues in decentralized districts are retained completely by the power holder. Our previous analysis boils down to the case of $\pi_J = 0$ in which the ruler is unconstrained. When π_J is higher, institutions are stronger, owing to the presence of stricter checks and balances on the ruler, to the greater power of legislative assemblies, constitutional review, and so forth. As a result, some fiscal revenue goes to power holders.[17]

5.1.1 Institutions and the Ruler's Decision to Centralize

Given a total amount $R_J = \kappa_J \cdot (A_m - A_h)$ of fiscal revenues collected in centralized districts, the ruler can only keep a share $(1 - \pi_J)$ of them for himself, for a total revenue equal to $\widetilde{R}_J = (1 - \pi_J) \cdot R_J$. The power holder of a centralized district then obtains $2\pi_J (A_m - A_h)$ over two periods. As a result, his loss from moving from decentralization to centralization is equal to $2 [(A_l - A_h) - \pi_J (A_m - A_h)]$. When

$$\pi_J \geq \widehat{\pi}_J \equiv \frac{(A_l - A_h)}{(A_m - A_h)}, \tag{25}$$

institutions are so strong that the power holder gains from centralization! When institutions are that strong, the ruler can commit to a mutually advantageous revenue-sharing arrangement with power holders, so there is no opposition to state building.

The interesting case arises when $\pi_J < \widehat{\pi}_J$. Now there is some opposition to reform, but the severity of such opposition decreases in the strength of institutions π_J. Optimal centralization here solves a cost-benefit tradeoff. To see how this works, we need to replace R_J with $\widetilde{R}_J$ in the maximization problems (12) and (13). By noting that $\kappa_J = \widetilde{R}_J / (A_m - A_h) \cdot \pi_J$, it is easy to see

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[17]This arrangement can be viewed as giving to a representative assembly some control over both taxation and spending, where π_J is the share of spending going to the benefit of local elites.

We have also solved the model under the alternative assumption that a representative assembly of power holders from centralized districts has the right to vote to decide whether to give all of their fiscal revenues to the central ruler or not. We assumed that local powerholders lose the fixed amount $L > 0$ when their country is defeated, which implies that theey have some incentive to let the central ruler grab fiscal revenue if a war threat is present. In this case, under a linear contest success function, the assembly hands over all fiscal revenues to the ruler provided $\lambda L > 1$. This formalization allows: i) the financing of war to become a common interest public good, and thus ii) the cost of centralization to depend on the severity of the war threat. This more nuanced portrayal of institutions renders the analysis more complicated but does not change our main results.

that in order to obtain a fiscal revenue $\widetilde{R}_J = (1 - \pi_J) \cdot R_J$ the ruler must bear the cost:

$$C_J(\widetilde{R}_J) = \widetilde{c}_J \cdot \widetilde{R}_J^2, \quad \text{where} \quad \widetilde{c}_J \equiv \frac{1}{\widetilde{R}_{J,aut}}, \tag{26}$$

where, in the spirit of Equation (8), we have that:

$$\widetilde{R}_{J,aut} = (1 - \pi_J) \cdot R_c \cdot \min \left[\frac{(1 - \pi_J)}{(A_l - A_h) - \pi_J (A_m - A_h)} \frac{(A_m - A_h)}{B_J}, 1 \right]. \tag{27}$$

Stronger institutions exert two conflicting effects on $\widetilde{R}_{J,aut}$. On the one hand, higher π_J reduces opposition to reform, increasing fiscal revenues. This is captured by the term π_J inside the square brackets. On the other hand, higher π_J reduces the share of fiscal revenues appropriated by the ruler. This is captured by the term $(1 - \pi_J)$ outside of the square brackets. In the realistic case where the efficiency gains of centralization are large (i.e. $(A_m - A_h) > 2(A_l - A_h)$), which we assume throughout, the first effect dominates. As a result, better institutions reduce the political cost of centralization.

Since in our model stronger institutions correspond to a reduction in the marginal cost of state building, country H has a lower cost of centralization than F, that is $\widetilde{c}_H \leq \widetilde{c}_F$, provided:

$$\frac{(1 - \pi_H)}{(A_{l,H} - A_{h,H}) - \pi_H (A_{m,H} - A_{h,H})} \cdot \frac{1}{B_H} \geq \frac{(1 - \pi_F)}{(A_{l,F} - A_{h,F}) - \pi_F (A_{m,F} - A_{h,F})} \cdot \frac{1}{B_F}, \tag{28}$$

namely when institutions in H are strong relative to the intensity of domestic conflict in the same country. Even if country H is "more divided" than F (i.e. if $B_H > B_F$) its ruler can face weaker domestic opposition if institutions constrain him sufficiently more than the ruler than country F.

The impact of institutions on centralization then directly follows the logic of Propositions 2 and 3. Equation (23) says that, under a linear contest success function, war *amplifies* differences in the domestic cost of reform. That is, the country having relatively better institutions centralizes more than the country having worse institutions, because the cost of reform is smaller in the former. In a sense, institutions turn state building into a common interest public good. When π_J is high, not only the central ruler, but also local power holders, benefit from centralization.

5.1.2 External Wars, Centralization and Institutional Change

Consider now the link between external wars and institutional change. Suppose that rulers - before centralizing - can strengthen their institutions at some cost. At the outset $\pi_{0,J} = 0$ and ruler J

can upgrade his institution to a level $\pi_J > 0$ by spending $K(\pi_J)$, where $K()$ is an increasing and convex function. The cost of institutional upgrade is uniform across countries, while its benefit is country specific, owing to cross country differences in domestic conflict. The Appendix then proves that for any contest success function satisfying the general properties stated in Section 3.3:

Proposition 4 *Denote by $W_J(\pi_J, B_J)$ the equilibrium welfare of ruler $J = H, F$. At a common level of institutions $\pi_H = \pi_F = \pi$ ruler H benefits more than ruler F from institutional improvements, i.e. $\left.\frac{\partial W_H}{\partial \pi_H}\right|_{\pi_H=\pi} > \left.\frac{\partial W_F}{\partial \pi_F}\right|_{\pi_F=\pi}$ if and only if:*

$$\frac{\widetilde{R}_H^*/\widetilde{R}_{H,aut}}{\widetilde{R}_F^*/\widetilde{R}_{F,aut}} \cdot \frac{\widetilde{R}_H^*}{\widetilde{R}_F^*} > 1. \tag{29}$$

To see this result, suppose there is no external war. In this case, $\widetilde{R}_J^* = \widetilde{R}_{J,aut}$ and the first factor on the left hand side of Equation (29) drops out. According to the second factor, then, country H benefits more than F from institutional upgrading if and only if it is less divided than F to begin with (i.e., if $\widetilde{R}_{H,aut} > \widetilde{R}_{F,aut}$). This is because in countries that are highly fragmented (i.e. have higher B_J), a marginal improvement in institutions appease few domestic opponents, reducing the cost of reform only by a little. In contrast, in countries where domestic conflict is less marked, domestic opposition is very "elastic" to an increase in π_J. As a result, an improvement in institutions greatly boosts state building. These effects amplify inequality among countries, favouring institutional development in the more cohesive country.[18]

Consider now the role of external war. Now the first term in (29) does not drop out because $\widetilde{R}_J^* \neq \widetilde{R}_{J,aut}$.[19] As a result, the less divided country H becomes even more eager to upgrade institutions relative to F precisely when war boosts divergence in centralization. That is, provided $\widetilde{R}_H^*/\widetilde{R}_F^* > \widetilde{R}_{H,aut}/\widetilde{R}_{F,aut}$. In contrast, if external war induces convergence in centralization, it also dampens cross-country differences in institutions. That is, wars boost inequality in institutional development when they increase inequality in state building.

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[18] The higher elasticity of domestic opposition in more cohesive countries is due to the assumption of uniformly distributed β. Uniformity on the other hand implies that elasticities become degenrate at corners. For example, in countries where domestic conflicts is so small that reforms are always undertaken, better institutions do not play a role. Recall however that we realistically assued that in all countries conflicts are sufficiently strong that in autraky centralization is partial (i.e. $B_J > (A_m - A_h)/(A_l - A_h)$) and that institutions are sufficiently weak that some conflict is present (i.e. $\pi_J < \widehat{\pi}_J$).

[19] With respect to the second term, provided the contest success function is symmetric (which is our main case of study) it is still true that $\widetilde{R}_H^* > \widetilde{R}_F^*$ if H is less divided than F. Hence, the second factor in (29) continues to enhance the benefit of institutional upgrading in the less divided country.

We can now characterize the patterns of institutional upgrading prevailing in the linear and symmetric contest success function of Proposition 2:

Corollary 1 *Denote by $\pi_{J,aut}$ the endogenously chosen degree of institutional upgrading by ruler $J = H, F$ in autarky and by $\widetilde{R}_{J,aut}$ and $\widetilde{c}_J$ the associated autarky revenues and marginal cost, respectively. Denote by κ_J^* and π_J^* the equilibrium centralization and institutions prevailing in country J when an external threat is present (i.e., when $\theta > 0$). We then have*
1) Institutions and centralization in J are stronger than in autarky if and only if $\lambda > 3 \cdot \widetilde{c}_J/4$
2) If centralization and institutions are partial, namely $\kappa_J^* < 1$ and $\pi_J^* < \widehat{\pi}_J$ for $J = H, F$, the less divided country has higher κ_J^* and π_J^* than its opponent.

As in Besley and Persson (2010), different dimensions of state development - centralization and institutions - cluster together. In a cohesive country, institutional upgradings are effective at reducing opposition to centralization. Thus, the ruler invests in such upgradings, particularly when he must meet an external war threat. In highly divided countries instead, only large institutional upgradings can effectively reduce domestic opposition to centralization. This discourages the ruler from undertaking strong institutional upgradings or state building, stifling all reforms.

The strength of these effects is shaped by the sensitivity of the war outcome to fiscal revenues. Much in the spirit of Figure 6, when λ is low the external war threat dampens investments in institutions and centralization in all countries. As λ becomes intermediate, only the ruler of the less divided country disproportionately boosts his centralization and institutions, generating strong divergence. As λ becomes very large, all rulers face enormous incentives to invest in institutions and state buildings, leading to the emergence of strong and accountable states. The statistical analysis in Dincecco (2009) - who shows that centralized and constrained governments in Europe taxed more than fragmented or "absolutist" entities between 1650 and 1913 – is fully in line with the predictions of our model here.

5.2 The Choice to Go to War

So far we treated the outbreak of war as exogenous. In reality, going to war reflects political choices. We now extend our model to analyze a ruler's decision of whether or not to go to war. This generates predictions on the link between state building and the frequency of war.

As in the previous analysis, assume that a war trigger arises exogenously with probability θ. Both rulers have financed their armies using their fiscal revenues and these are armies ready to

go to war. However, they can now choose whether to go to war or not based on their expected payoff from doing so. If the war is averted, the ruler will enjoy his own future fiscal revenues with probability one. If war occurs, the ruler will enjoy the future fiscal revenues of both countries with some probability, and nothing otherwise.

To make things interesting, we assume that war destroys a share $(1 - \sigma) > 0$ of fiscal revenues at $t = 2$ in all countries. This implies that: i) it is impossible for both rulers to expect to gain from war, and ii) there may be circumstances where both rulers lose from the war, so that war does not always occur. In general, when $\sigma < 1$ it would be mutually beneficial for rulers to renegotiate the war away, but here we realistically assume that such renegotiations are impossible because rulers cannot commit to make the necessary transfers.

This setup implies that if at $t = 1$ a war trigger materializes, two things can happen. First, both rulers may expect to lose from the war. In this case, military conflict is averted. Alternatively, either ruler expects to gain from war. In this case, military conflict erupts. Clearly, the possibility of not going to war affects also the decision of how much to centralize ex-ante, which naturally depends on the (now endogenous) probability of going to war at $t = 1$.

To see how these effects play out, let us solve the model backwards. Given the equilibrium revenues (R_H^*, R_F^*), and conditional on the realization of a war event, conflict occurs either when H gains from triggering a war, formally when:

$$p(R_H^*, R_F^*) \cdot \sigma \cdot (R_H^* + R_F^*) \geq R_H^*, \tag{30}$$

or when F gains from triggering a war, namely when:

$$[1 - p(R_H^*, R_F^*)] \cdot \sigma \cdot (R_H^* + R_F^*) \geq R_F^*. \tag{31}$$

War is averted if and only if none of the above conditions holds. Intuitively, (30) and (31) ensure that a ruler's expected revenue from going to war - the left hand side in the above expressions - is higher than what he can obtain by taxing only his own economy - the right hand side above.

Under a symmetric contest success function [i.e. such that $p(R, R) = 1/2$], war cannot occur if countries have identical revenues $(R_H = R_F)$; in this case, the war prize is awarded with a coin toss and no ruler can expect to obtain from war more than his own revenues. In fact, since $\sigma < 1$, both rulers expect to lose from war. Hence, when $R_H = R_F$ both rulers prefer a peaceful outcome. The incentive to go to war arises if countries are unequal, namely $R_H \neq R_F$. In this case, the war

heavily favors one contestant, who is therefore eager to initiate conflict. To solve for the equilibrium of the model, we must take into account that: i) the probability of conflict depends on rulers' fiscal revenues, and ii) the optimal degree of centralization, and equilibrium revenues themselves, depend on the expectation of military conflict. In other words, the probability of conflict and investment in state building are jointly determined in equilibrium. The Appendix shows that under the linear contest success function of Proposition 2 the following result obtains.

Proposition 5 *Denote by λ^* the sensitivity of war outcomes to financial resources at which $\max(R_H^*, R_F^*) = (A_m - A_h)$, so that for $\lambda \leq \lambda^*$ state building in the two countries is partial. Then, there exist two thresholds λ_0, λ_1 where $0 \leq \lambda_0 < \lambda_1 \leq \lambda^*$ such that, conditional on the realization of a war event:*
1) If $\lambda \leq \lambda_0$, war occurs with probability one and the less wealthy ruler expects to benefit from it
2) If $\lambda \in (\lambda_0, \lambda_1)$, the equilibrium is in mixed strategies and war occurs with probability $\omega \in [0, 1)$.
3) If $\lambda \geq \lambda_1$, war occurs with probability one and the wealthier ruler stands to benefit from it.

War is most likely to arise if financial resources influence military success either to a great extent, or hardly at all. Crucially, the identity of the party initiating conflict is different in these two cases. When the influence of financial resources on military success is high, the wealthier country is the one initiating conflict. Because this country is disproportionately more likely to win the war, it is eager to attack. In effect, with λ high enough, war behaves like a "superior good", which is consumed to a greater extent as a ruler grows his fiscal resources (holding his competitor's resources constant). When instead the influence of financial resources on military success is low, the less wealthy country is the one initiating conflict. Because at low λ the less wealthy country wins with non-negligible probability, so that the prospect of conquering a more wealthy opponent acts as an inducement to conflict.

Matters are more complicated when λ is intermediate. Relative to the extent of war destructions, the probability with which either ruler wins is too low for military conflict to be appealing. One possibility in this range is that war does not occur at all, i.e. $\omega = 0$. In this case, at $t = 0$ the rulers invest as in autarky. This is an equilibrium only if in turn, at the autarky revenues, no ruler has an incentive to go to war at $t = 1$. If however at the autarky revenues one ruler wishes to initiate conflict, the equilibrium is in mixed strategies: conditional on a war trigger θ war occurs with positive probability $\omega \in (0, 1)$. The level of ω is then determined so that - at the ex-ante probability of war $\theta \cdot \omega$ - the optimal investments in state building at $t = 0$ renders the more belligerent ruler just indifferent between initiating the war or not at $t = 1$ (and thus willing to

randomize the decision of whether or not to go to war). Regardless of the specific value taken by ω in equilibrium, the general point here is that at intermediate levels of λ the probability of conflict goes down relative to the case where λ takes extreme values.

There are two important implications here. First, the link between the war technology and the frequency of military conflict is non-linear. War can happen frequently both when the military technology is highly developed and expensive (i.e. λ is high) as well as when it is primitive (i.e. λ low).[20] Furthermore, when λ is so high that both war contenders become fully centralized (i.e. $\lambda >> \lambda^*$), a peaceful outcome also arises. As a result, it is difficult to draw univocal predictions linking the frequency of conflict, the war technology and state building.

Second, and more interestingly, the decision of whether to go to war or not creates an additional channel whereby external threats should create convergence or divergence among countries. When the sensitivity of the war outcomes to fiscal revenues is low, military conflict is effectively a mechanism allowing weaker powers to gain by challenging more consolidated ones. As a result, when λ is low, state consolidation is weak not only because each ruler has little incentive to engage in state building on his own (as we saw in Section 4), but also because war "redistributes" fiscal revenues and territories from larger to countries to smaller ones, fostering fragmentation. In contrast, when the sensitivity of the war outcome to fiscal revenues is high, military conflict is a mechanism allowing strong powers to take over weaker ones. As a result, state consolidation is extensive for two reasons – first, because each ruler has strong incentives to invest on his own, and second, because war is likely to redistribute fiscal revenues and territories from smaller countries to larger ones, increasing concentration. Thus, our model shows that the two key paths to the formation of strong states – the creation of a centralized authority and the conquest of weaker countries – do not operate independently but are jointly shaped by the realities of warmaking.

6   Empirical Evidence

We now shed light on the patterns of state consolidation in early modern Europe by focusing on the two key driving factors of centralization stressed by our model: the increasing importance of money for determining military success and cross-country differences in domestic conflicts.

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[20]For $\lambda > \lambda^*$ the sensitivity of war to fiscal revenues is so high that the two countries become very equal (both approaching full centralization), and the incentive to go to war disappears again.

6.1 England versus Spain: a study in contrasts

To begin, we compare state building in early modern Britain and Spain. During the period 1500-1800, both were at one point dominant powers at the height of their influence; both fought numerous wars, and both accumulated large quantities of debt. And yet, Spain quickly declined as a European power, while Britain dominated the European concert of powers for centuries and assembled the greatest empire in history.

While many scholars have examined the success of Britain and the failure of Spain, the divergence in state capacity deserves to be underlined. Spain during the 16th century was the superpower of its age. In 1550, it had more men under arms than any other power in Europe. At its height, under Philip II, the empire was so large that the sun literally never set on it. And yet, Spain declined quickly as a European power. By 1700, a mere century and a half after its apogee, its armed forces were less than half as big as they had been in 1550. In Spain, some of the earlier successes in state-building had gone into reverse by the 17 century; the country's decline as a European power paralleled the reduction in fiscal and other resources of the Crown.

As predicted by our model, internal fragmentation was a key constraint: Castile was heavily taxed, but other regions hardly contributed at all to Madrid's revenues. Spain failed to overcome this challenge. Aggressive attempts to levy taxes outside Castile typically came to nothing (such as, for example, under the Count-Duke Olivares during the Thirty Years War). Cities and entire kingdoms successfully claimed tax exemptions. Not even the Crown's monopoly over military resources was successfully asserted: By the 17th century, the arsenals of grandees, such as the one of the Duke of Medina-Sidonia, were once more sufficient to equip a small army (Anderson 1988).

Britain, on the other hand, gradually evolved into a highly centralized and effective state. Armed force was concentrated in the hands of the central authority. Taxation became uniform and relatively effective. Total revenue surged as the Customs and Excise took over the collection of indirect taxes after the 1690. Eventually, Britain introduced the first successfully income tax in history. Its finances were also solid enough to sustain an enormous accumulation of debt – over 200% of GDP by 1820. During the period 1500 to 1815, England went from marginal player to the dominant power in Europe, largely as a result of its superior fiscal capacity (Brewer 1988, Ferguson 2002). The Royal Navy ruled the sea; it eventually built the largest empire in history.

Figure 7 here

As Figure 9 illustrates, despite the greater underlying heterogeneity of Spain, the two countries were similarly effective at raising revenues in 1500. Strong divergence between Britain and Spain only emerged in the second half of the 17th century, which is precisely when the military revolution's effects became particularly strong. Although both countries faced the same increase in the cost of conflict, the consequences were quite different.

Consistent with our model, differences in internal fragmentation became problematic for Spain precisely when state capacity became crucial for military success.[21] We emphasize the importance of starting conditions. Spain emerged from the Union of Crowns, joining Castile and Aragon – just as Britain emerged from the Union of Crowns between Scotland and England. In the British case, however, an Act of Union followed the Union of Crowns – Scotland was integrated into Britain administratively, in terms of taxes, and in terms of jurisdiction.[22] Even at the beginning of the early modern period, the kings of England faced a much less fragmented and heterogeneous realm than their competitors on the Iberian peninsula. Apart from Wales, cultural and linguistic fragmentation was relatively limited; cities were not represented directly in parliament. In Spain, every Royal territory continued to have its own laws, customs barriers separated Madrid from Pamplona and Barcelona, and many veto players insisted on their ancient freedoms. Indeed, constitutional theory in many parts of the peninsula held that the king's position depended on the upholding of medieval customary rights. In this way, new laws and edicts that tried to reduce privileges could be legitimately ignored by officials and citizens alike. One ready indicator of fragmentation is the ease of rebellion. While England succeeded in extending tax jurisdiction to Wales and Scotland, Castile failed at the same task. When a serious attempt was made (under Olivares, the so-called "Union de Armas"), armed rebellion in Catalunya, Portugal, and Naples followed. Even if only one of these succeeded, the centralizing agenda in Spain suffered a permanent setback. Rebellious territories, even after being defeated, kept most of their ancient rights. As John Elliott (1969) put it: "Such strength as it [the Spanish Monarchy] possessed derived from its weakness."[23]

Consistent with our model, the divergent paths of England and Spain also hold a lesson about

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[21] Here, we differ from the classification in Dincecco (2009), who characterizes Britain before 1690 as centralized and absolutist. For our purposes, fragmentation in tax collection - with delegation of tax powers to the cities - is what matters, and it was broadly similar in Britain and Spain. Only after the introduction of the Customs and Excise does the collection of indirect taxation become more centralized.

[22] Several provisions of the Act of Union were actually ignored, such as tax exemptions and special rules for the kirk.

[23] In the 18th century, the Bourbon kings made another attempt at centralization. While they succeeded in eliminating ancient "freedoms" in Catalunya, they did not succeed in permanently centralizing and consolidating power. For example, internal customs barriers were quickly re-erected (Grafe 2011).

the co-evolution of institutional change and state building. England's ability to raise revenue was not impressive until after the "Glorious Revolution" in 1688 (North and Weingast 1989). We are not the first to note that the 1688 allowed a "grand bargain" to be struck between Crown and parliament, allowing more oversight and control by the latter in exchange for far greater revenue-raising by the former. By strengthening constraints on the executive in a fairly unified country, the optimum rate of centralization actually increased markedly. Our model offers a perspective for why this bargain could be struck – and why it resulted in much greater fiscal centralization and revenue raising – in England than elsewhere.

In sum, the contrast between Spain and England offers powerful support for the predictions of our model. Faced with the same shock - the rise in the cost of armed conflict due to the Military Revolution - one of them succeeded in building a centralized, highly capable state apparatus, while the other failed. Differences in starting conditions, especially in terms of initial fragmentation, were crucial for divergence.

6.2 The Military Revolution, Fragmentation and State Building in Early Modern Europe

We now provide some statistical evidence on the mechanism highlighted by our model for a cross section of early modern European countries. The goal of this analysis is not to identify the causal impact of the changing war technology and domestic divisions on state building, but rather to see whether the basic correlations in the data are consistent with our theory.

6.2.1 Money and military success

We first provide some evidence on the changing importance of money for military might by analyzing data on the outcomes of 263 major battles in Europe between 1500 and 1800. We focus on this period since it encompasses the entire period of the military revolution and the centuries during which state consolidation in Europe got under way. The data are from Jacques (2007), combined with fiscal data from Karaman and Pamuk (2010).[24]   For each battle, we code the outcome as either success or defeat. For each combatant state, we collect data on total tax revenue at the nearest point in time.

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[24]The Revolutionary Wars with France after 1793 were fought according to rules that differed markedly from those before, and we chose not to include them. The massive use of troops from conquered territories (which remained nominally independent) as well as the complex fiscal transfers during the period would complicate the analysis.

Table 3 here

A simple way to present results is given in Table 3. We show the number of battles won by the richer power (in terms of total revenue), as well as the odds ratio, for the early modern period, including subperiods. In the centuries after 1500, fiscally stronger powers actually won wars with greater frequency. As table 3 shows, the odds of success were 29 percent greater for the richer power. There is substantial change in the centuries after 1500. For the period 1500-1650, richer powers seem to have no advantage. Thereafter, they consistently win with greater frequency than their poorer opponents. By the end of the period, the richer powers prevail on the battlefield with odds that are twice as high as those of poorer belligerents.

Table 3 examines the odds of the richer contestant winning without using information on the revenue gap between contestants. To account for this latter aspect, we next estimate the likelihood of success for the fiscally stronger power as a function of the revenue ratio between both sides:

$$S_{H,t} = C + \widehat{\lambda_1} R_{H,t} + \widehat{\lambda_2} R_{L,t} + \epsilon_{H,t} \tag{32}$$

where $S_{H,t}$ is a dummy variable equal to unity if the stronger power wins, and zero otherwise, C is a constant, $A_{H,t}$ is a dummy indicating the presence of allies on the side of the fiscally stronger power, and $R_{H,t}$ is the revenue of the fiscally stronger power, $R_{L,t}$ is the revenue of the fiscally weaker power. The coefficients $\widehat{\lambda}$ capture the importance of money for winning a war, providing a proxy for the sensitivity of war outcomes to fiscal revenues λ in our model.

We estimate both linear probability models under OLS and probit regressions. The dependent variable takes the value of unity if the richer power wins, and zero otherwise. Table 4 gives the results. The intercept in column (1) is close to 0.5, indicating that without taking fiscal variables into account, the likely outcome of a battle is well-approximated by a coin flip. The higher the revenues of the richer power, the greater the likelihood of success. Conversely, the richer the weaker power is, the smaller the likelihood of the richer power winning. The coefficients are of meaningful size - a one standard deviation increase in the revenues of the richer power is associated with an increase in the success ratio of 0.25. These results are confirmed under probit estimation.

The estimated coefficient λ also changes substantially over time. Before 1650, the broad pattern is similar as for the sample as a whole, but effects are not tightly estimated - while greater fiscal resources were associated with winning more often on the battlefield, other factors were also clearly important. After 1650, the coefficients are tightly estimated and highly significant.

Table 4 here

We therefore find that after 1650, fiscal revenue became a much better predictor of battlefield success. This is consistent with the basic driving force behind state building in our model: an increase in the sensitivity of the war outcome to fiscal revenues.

6.2.2   Fragmentation, the Military Revolution and state building

Our model predicts that a state's ability to raise taxes depends on country-specific characteristics that may hinder centralizing efforts. We use data on fiscal revenues per capita over the period 1500-1800, measured as grams of silver per capita.[25]

To measure the ability of a prince to pursue a state-building agenda, we use a simple measure - the number of states on a country's territory in 1300, a full two centuries before the start of our sample period. In feudal societies, territorial expansion went hand-in-hand with a new set of local magnates becoming vassals of the king or prince. Therefore, the number of predecessor states can proxy for the strength of domestic opposition - the extent to which local power-holders can resist centripetal forces.

Figures 8 here

In Figure 8, we examine how tax-raising interacted with prior territorial divisions in Europe after 1500, by tercile of the distribution of the number of predecessor states. The size of each box indicates the 25th and 75th percentiles, while the median is indicated inside it. The "whiskers" show the rest of the distributional range. There is a clear inverse pattern between the number of predecessor states on a country's territory and the average tax take in grams of silver per capita. The quintiles are ordered from 1st (lowest number of prior states) to 5 (highest quintile). There is substantial heterogeneity, especially at lower levels, as indicated by the wide range of the box and whiskers plot. At the same time, the only states with substantial income are the ones in the lowest quintile of the number of predecessor states. At the opposite end of the spectrum, amongst those states with a high number of predecessors, the average tax take is very low, and there is little variation overall. This suggests that ruling a territory with few predecessor states is a necessary, but not a sufficient condition for raising revenues.

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[25] The data come from Karaman and Pamuk (2008), augmented by information from the European State Finance Database.

Table 5 here

Next, we examine if the relationships plotted in figure 8 is statistically significant and of a meaningful size. In table 5, we therefore estimate

$$R_{i,t} = C + \beta \cdot B_{i,t} + \delta D_{post1650} + \rho B_{i,t} D_{post1650} + \epsilon_{i,t}$$

where $R_{i,t}$ is tax revenue (grams of silver per capita), which serves as our measure of fiscal capacity, $B_{i,t}$ is the number of predecessor states, $D_{post1650}$ is a dummy that takes the value of unity if observations are from years after 1650, and zero otherwise. We obtain a significant, large and negative effect, independent of whether we use robust or clustered standard errors. States with a one standard deviation higher number of predecessor states see tax collection that is, on average 18 grams of silver per capita lower, equivalent to half of the dependent variable's mean. Table 5 also shows that the result is driven by observations after 1650, when the military revolution made itself fully felt. For the period before 1650, the coefficient is negative, but small and insignificant. Thereafter, it increases eightfold in size and becomes highly significant. As column 4 demonstrates, the difference between the period before and after 1650 is highly significant.

Many measures of internal fragmentation could be considered to proxy for the potential strength of domestic opposition. We now show that the overall pattern also holds more broadly when using an alternative measure of domestic opposition - the impact of ethnic heterogeneity (Table 6, panel A). Ethnic divisions often undermine establishing effective central control. As the results in Table 6 demonstrate, this was also true in the early modern period. There is a negative effect of the Alesina measure of ethnic heterogeneity on tax raising powers. The effect is significant if we use robust standard errors; if we cluster at the country level, it is not significant. As columns 2+3 show, the effect gets bigger after 1650; in column 4, the interaction effect between the post1650-dummy and the ethnic divisions measure is large and negative, but marginally below standard levels of significance with clustered errors.

Table 6 here

Our model also predicts that geographical features - such as the ease with which central control can be extended to more remote regions – should influence the ability to raise revenues. In Panel B, we test this more explicitly. We use two variables - the average slope of terrain, and the percentage

of the urban population within 300 km of the capital. Both should capture the ease with which a prince can expand his span of control throughout the country. As the results in table 6, panel B show, a higher urban share close to the capital is positively associated with tax revenue, while a more rugged terrain is negatively correlated. The effects are strong and significant with robust standard errors; when we use clustering, they are below the cut-off for significance.

Overall, our empirical results provide support for the following predictions of the model: First, the importance of money grew rapidly as the "Military Revolution" got under way. By the end of the early modern period, richer belligerents won wars with much greater frequency. Second, the ease with which revenue could be raised depended to an important extent on pre-existing domestic divisions, such as the number of predecessor states on a territory, ethnic heterogeneity, and the ease with which rich, taxable populations could be reached from a capital.

7   Conclusion

Centralized, powerful states are a relatively recent invention in the history of mankind. In many parts of the world, states do not have a monopoly of violence, collect only a small share of GDP as taxes, and provide few essential services. To understand how state capacity came to be high in some countries, we analyze the origins of European states in the early modern period. We build a model that is designed to give insight into the process by which these powers eventually build large, efficient, centralized states. We emphasize the importance of internal centralization, which went hand-in-hand with consolidation of hundreds of states and statelets into a small number of highly successful states. We also shed light on the transformation of the European state system that allowed a handful of consolidated states to emerge.

In our model, princes consider whether to invest in state capacity - centralizing tax collection, wresting control over tariffs and the judiciary from local princes, etc. Powers differ in their pre-existing levels of fragmentation. Without the threat of war, princes have to trade off the gains in terms of revenue against the threat of rebellion. A highly fragmented territory requires a lot of efforts to become unified; a more uniform state will have the same benefit, but requires less time and effort in investing in "state capacity".

The threat of war changes the calculus. On the one hand, monarchs now have to fear that they may be attacked, and territory (and treasure) taken from them. This reduces their incentive to invest in state capacity, since the gains may be smaller than in autarchy. At the same time,

the need to fight wars makes money more valuable. This increases the incentive to invest in state capacity, by strengthening the tax bureaucracy, etc. How strong these two effects are depends on i. each power's initial fragmentation – shorthand for the threat of revolt ii. how costly wars are. Everything else equal, expensive wars make it more attractive to invest in centralization.

During the early modern period, the cost of war grew exponentially - armies increased in size, equipping them became vastly more costly, and wars lasted longer. In our model, at some point, war is so costly that at least the stronger, more centralized power finds it worthwhile to invest in greater state capacity because of the threat of war. The weaker power, on the other hand, will simply invest less, and may drop out of power competition altogether. As the cost of war increases even further, the importance of money for survival starts to outweigh the dangers of rebellion. Therefore, when wars are very costly, both the unified and the fragmented power invest in state capacity.

We apply our framework to the case of early modern Europe. Successful states tore up the ancient "liberties" of towns, clergy, and the nobility, ignored laws based on custom, imposed legal norms uniformly, and abolished tax exemptions. By 1800, a patchwork of small and weak states had consolidated into a few, powerful entities that enjoyed a monopoly of violence internally, jurisdictional unity, and the power to tax on a vast scale. We argue that Europe's rise to global domination after 1500 reflects a benign externality of the intense struggle for supremacy in Europe. The exogenous shock that set off the rise of European state capacity was that wars became ever more costly after 1500, as a result of the "Military Revolution". As the cost of conflict rose, rulers needed to tax more and centralize revenue collection to ensure their independence. Weaker powers increasingly dropped out of the competition and often disappeared from the map, leaving the field to their more potent competitors. In this way, our model explains how, in response to the rising cost of conflict, average state capacity in Europe grew dramatically, while only a few consolidated, powerful states survived.

In the empirical part of our paper, we examine the model's predictions. We first show how the importance of financial resources for success on the battlefield changed. As the "Military Revolution" unfolded, richer powers won with increasing frequency. There is also empirical support for our argument that raising taxes was markedly more difficult in fragmented (and fractious) states. Where states were composed of many predecessor states, for example, rulers succeeded less in increasing tax pressure. A highly concentrated network of urban centers, on the other hand, facilitated the growth of the tax state.

Our model also explains how the growing importance of fiscal revenue for success on the battlefield helped to improve institutions. Where rulers could commit to revenue sharing with local power holders, resistance to reform and centralization was weaker. Under ideal circumstances, this led to the creation of a "consensually strong" state (Acemoglu 2005), which becomes centralized and powerful precisely because the ruler is constrained. We interpret the rise of Britain after 1689 in this light. In this sense, the rapidly rising cost of naval warfare increased the importance of revenue generation for the monarch. Initial levels of fragmentation were low, and centralization could proceed apace - resulting in such advances as the highly efficient customs & excise administration, and the first successful income tax in history - because crown and parliament could strike a deal that led to constraints on the former, while permitting an unprecedented rise in the percentage of output appropriated by the state.

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Tables

Table 1: Frequency of War

Century	Number of wars	Average duration (years)	Percentage years under warfare(%)
16th	34	1.6	95
17th	29	1.7	94
18th	17	1	78
19th	20	0.4	40
20th	15	0.4	53

Source: Tilly 1990

Table 2: Army size in Early Modern Europe (in 1,000s)

	1550			1700			1780		
	army	navy	total	army	navy	total	army	navy	total
England	41	25	**66**	76	115	**191**	79	109	**188**
France	43	14	**57**	224	118	**342**	183	85	**268**
Dutch Republic				90	86	**176**	27	22	**49**
Spain	145	18	**163**	37	26	**63**	64	62	**126**
Austria	9	0	**9**	62	0	**62**	253	0	**253**
Prussia				37	0	**37**	181	0	**181**
Russia				52	0	**52**	408	19	**427**
Ottoman Empire	90	50	**140**	130	30	**160**	120	30	**150**

Table 3: War and fiscal resources (land battles only)

	richer	wins?	
	Y	**N**	**odds of success (richer power)**
1500-1800	148	115	1.29
1500-1550	4	12	0.33
1550-1600	0	4	0
1600-1650	6	16	0.375
1650-1700	21	16	1.31
1700-1750	19	16	1.19
1750-1775	27	14	1.93
1775-1800	71	37	1.92

Table 4: Battlefield success and relative fiscal strength

	(1)	(2)	(3)	(4)	(5)	(6)
sample	all	pre1650	post1650	all	pre1650	post1650
estimator	OLS	OLS	OLS	probit	probit	probit
main						
Rev_richer	0.334***	0.386	0.261***	0.893***	1.149	0.710***
	(4.43)	(1.14)	(3.75)	(4.26)	(1.15)	(3.70)
Rev_poorer	-0.502***	-0.721	-0.502***	-1.355***	-2.214	-1.365***
	(-4.16)	(-1.87)	(-4.66)	(-3.91)	(-1.95)	(-4.34)
C	0.462***	0.243	0.593***	-0.0962	-0.692*	0.239
	(5.72)	(2.24)	(6.79)	(-0.47)	(-2.07)	(1.05)
R2	0.0694	0.00862	0.0507			
N	263	42	221	263	42	221

t statistics in parentheses

standard errors clustered at combatant-pair level

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5: Revenue raising and the number of predecessor states in 1300

	(1)	(2)	(3)	(4)
sample	all	before 1650	after 1650	interaction
predecessor1300	-1.84	-0.37	-2.76	-0.37
	(2.27)	(1.15)	(2.4)	(1.16)
	[4.1]	[1.4]	[4.3]	[1.4]
post1650				60.2
				(2.9)
				[4.1]
interaction(pred1300*post1650)				-2.4
				(2.3)
				[3.4]
N	67	25	42	67
R^2	0.15	0.04	0.27	0.34

t-statistics in parentheses (standard error clustered at country level) [robust standard errors]

Table 6: Revenue raising and fragmentation - additional explanatory variables

Panel A: Alesina measure of ethnic heterogeneity (adjusted for population changes)

	(1)	(2)	(3)	(4)
sample	all	before 1650	after 1650	interaction
AEH	-111.6	-5.02	-186.4	-5.02
	(1.3)	(0.1)	(1.4)	(0.1)
	[2.6]	[0.1]	[2.6]	[0.15]
post1650				68.97
				(2.3)
				[3.4]
AEH*post1650				-181.4
				(1.68)
				[2.3]
N	67	25	42	67
R^2	0.066	0.001	0.12	0.22

AEH: Alesina ethnic heterogeneity (adjusted for post-1500 migrations)

t-statistics in parentheses (standard error clustered at country level) [robust standard errors]

Panel B: Geographic and economic determinants of revenue

	(1)	(2)	(3)
sample	all	before 1650	after 1650
slope	-216.6	-55.9	-199.7
	(1.1)	(0.47)	(0.9)
	[2.0]	[0.5]	[1.6]
Urbpop	49.6	8.5	91.9
	(1.2)	(0.5)	(1.44)
	[2.1]	[0.6]	[2.2]
N	66	25	41
R^2	0.17	0.05	0.26

slope - average slope of terrain; Urbpop - % of urban population within 300 km of capital
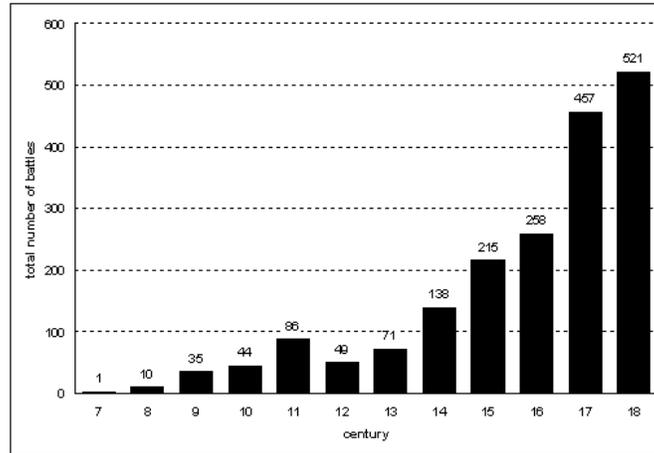
Figures

Figure 1: Number of Battles in Europe per Century
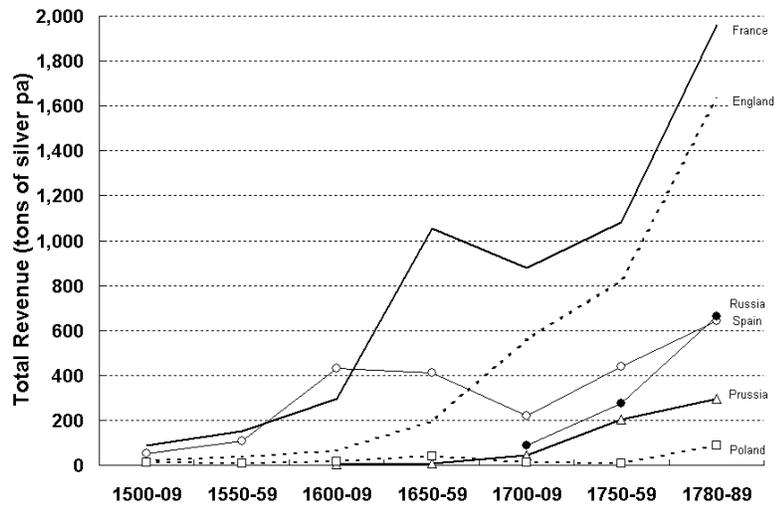
Figure 2: Fiscal Revenue in Europe, 1500-1780
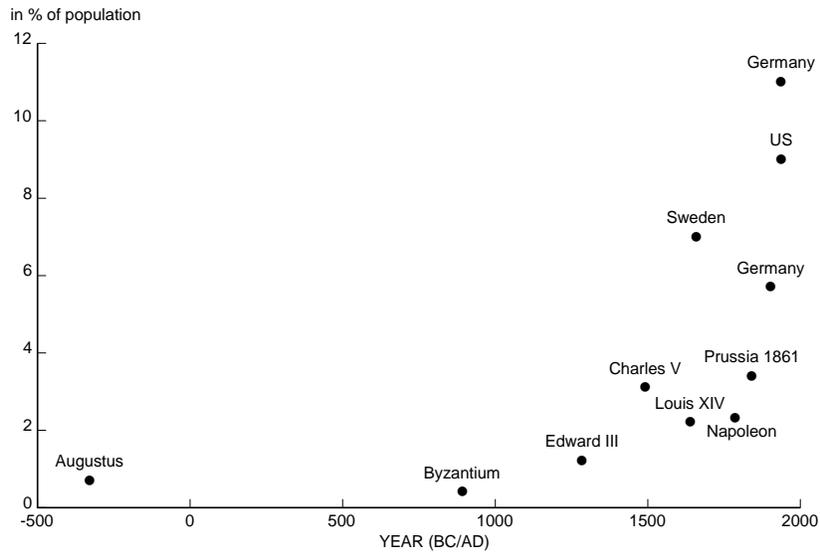
Figure 3: Army Size from Augustus to 1944
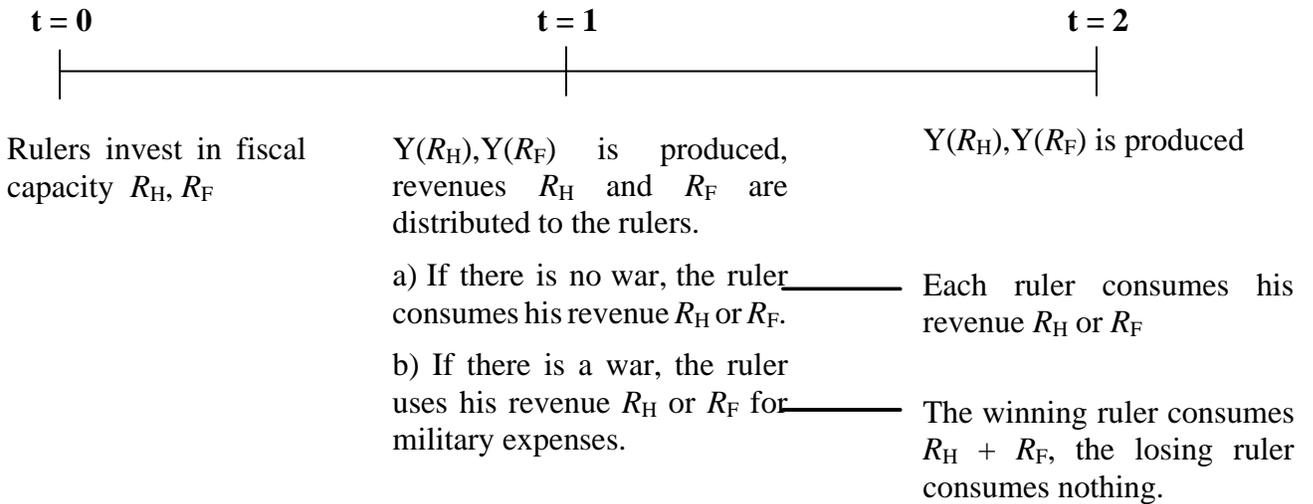
t = 0   **t = 1**   **t = 2**

Rulers invest in fiscal capacity R_H, R_F

$Y(R_H), Y(R_F)$ is produced, revenues R_H and R_F are distributed to the rulers.

$Y(R_H), Y(R_F)$ is produced

a) If there is no war, the ruler consumes his revenue R_H or R_F.

Each ruler consumes his revenue R_H or R_F

b) If there is a war, the ruler uses his revenue R_H or R_F for military expenses.

The winning ruler consumes $R_H + R_F$, the losing ruler consumes nothing.

Figure 4: Timing
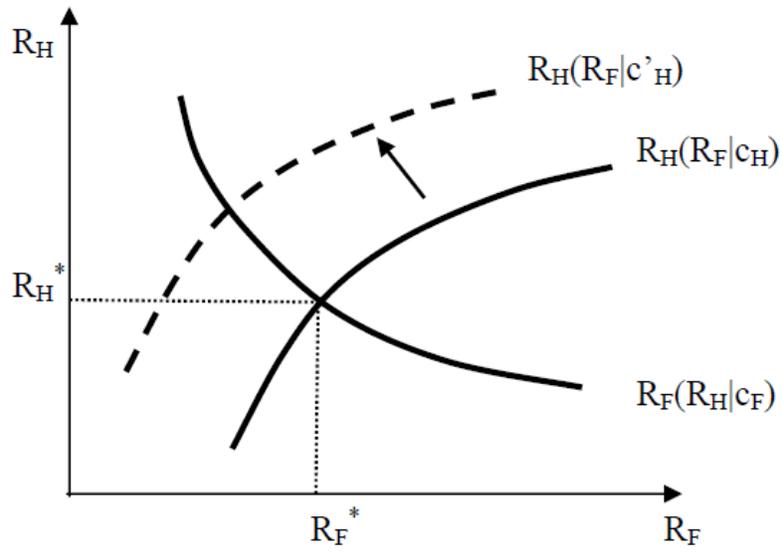
Figure 5: The effect of a reduction in the cost of reform c_H in the aggressive reformer H.

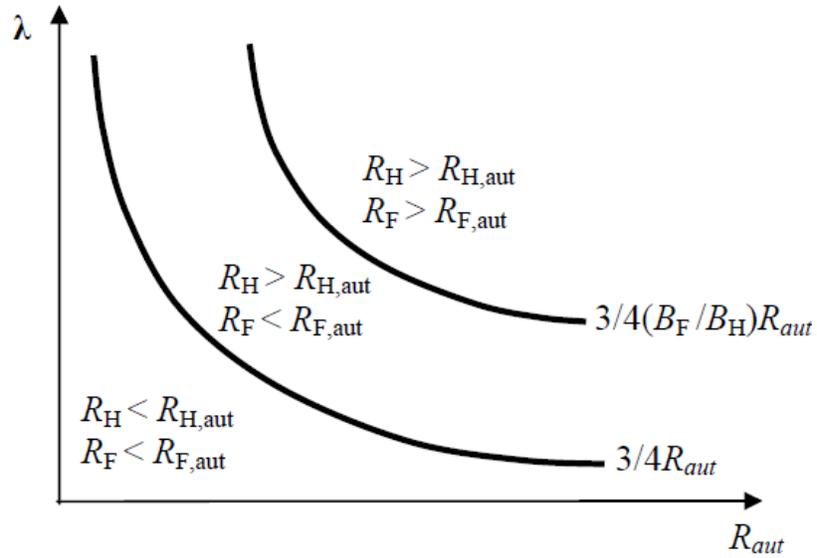Figure 6: Capital Intensity, Domestic Conflict, and State Building
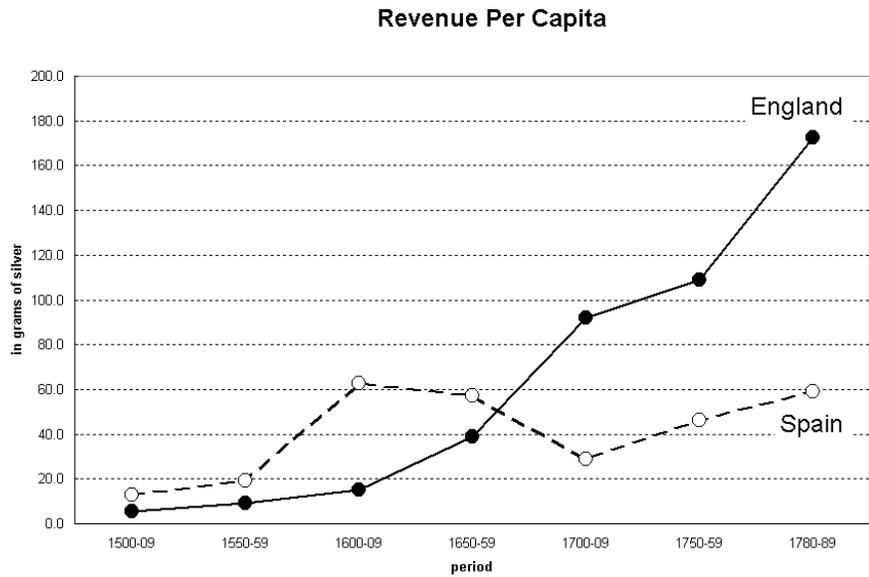
Revenue Per Capita

Figure 7: Revenue per capita, England and Spain
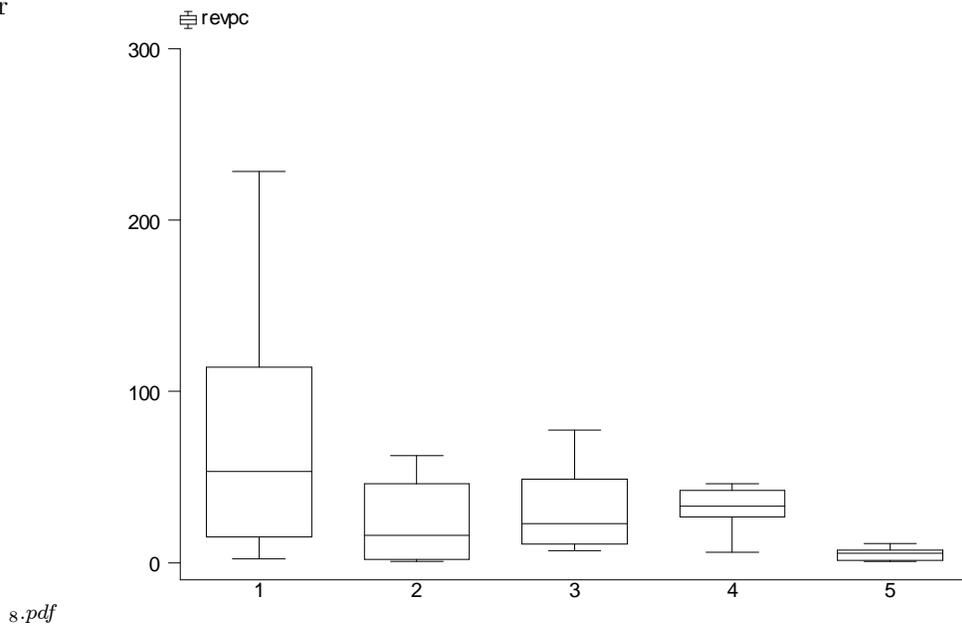
and predecessor

$_8.pdf$

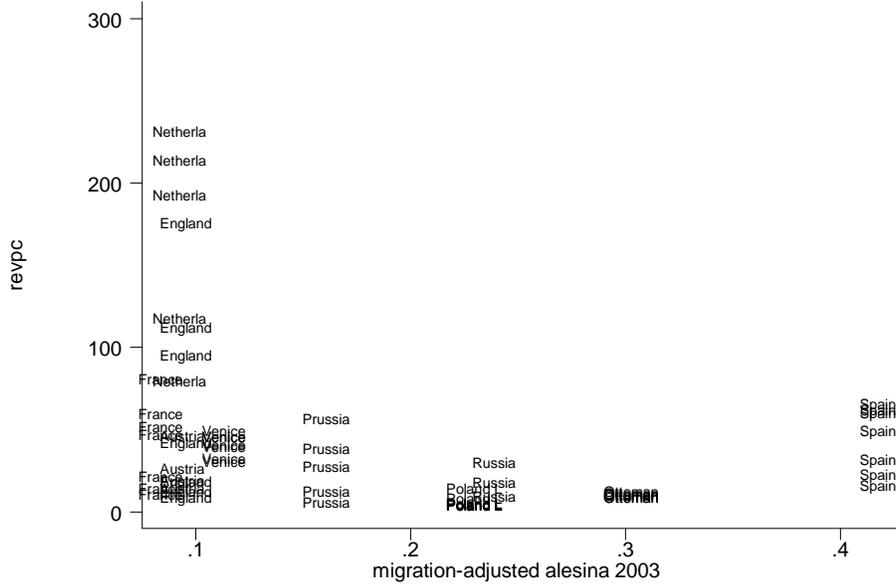Figure 8: Revenue by number of predecessor states (by quintile; 1=lowest)

Figure 9: Tax revenue and ethnic heterogeneity (Alesina-migration-adjusted)

Appendix 1: Proofs

Proof of Lemma 1. We want to show that the symmetric equilibrium of Lemma 1 where market production does not occur and only home production occurs always exists. Suppose that we are in such an equilibrium $(\tau_{l,d}, \tau_{m,d})$ and suppose that at the tax rate $\tau_{m,d}$ market production is les profitable than home production, namely $\max[0, (1 - 2\tau_{m,d})] A_m < A_h$. The question is whether it is profitable for an individual power holder i to deviate to a tax $\tau_{m,i}$ at which market production is profitable again. Remember that in the Equilibrum of Lemma 1 each power holder obtains $(A_l - A_h)$ by fully extracting the local production surplus.

If $\tau_{m,d} \geq (A_m - A_h)/A_m$, it is unprofitable for the local power holder i to deviate to a tax rate inducing market production, because such tax rate should be non-positive.

If $\tau_{m,d} < (A_m - A_h)/A_m$, the maximal tax rate that the power holder of district i could deviate to is equal to:

$$\tau_{m,i} = 1 - \tau_{m,d} - \frac{A_h}{A_m}.$$

At this tax rate, the local power holder induces all people in his district and in thee right adjiacent district to undertake market production. As a result, his tax revenue is equal to:

$$2A_m\tau_{m,i} = 2A_m(1 - \tau_{m,d}) - 2A_h.$$

This tax ravanue avaliable for power holder i is less than the rent $(A_l - A_h)$ that the same power holder obtains in the equilibrium of Lemma 1 (so that the deviation is not profitable) provided:

$$\tau_{m,d} > 1 - \frac{A_l + A_h}{2A_m}.$$

Thus, the equilibrium of Lemma 1 indeed exists for all parameter values. ∎

Proof of Proposition 1. Denote by $\Pi^j(R_H, R_F)$ the payoff of ruler $j = H, F$. The rulers' first order conditions are then equal to $\Pi^j_{R_j}(R_H, R_F) = 0$ for $j = H, F$, giving rise to Equations (14) and (15). These conditions guarantee an interior optimum if rulers' objective is concave, namely if $\Pi^j_{R_j R_j}(R_H, R_F) < 0$ for $j = H, F$. Concavity is equivalent to having:

$$(\theta/2)\left[p_{HH}(R_H + R_F) + 2p_H\right] - 1/R_{H,aut} \quad < \quad 0, \tag{33}$$

$$(\theta/2)\left[-p_{FF}(R_H + R_F) - 2p_F\right] - 1/R_{F,aut} \quad < \quad 0. \tag{34}$$

Throughout, we assume that concavity is fulfilled to study the properties of interior equilibria, if they exist. Applying the implicit function theorem to (14) and (15) we have that:

$$\frac{dR_H(R_F)}{dR_F} = \frac{\Pi^H_{R_F R_H}}{\left|\Pi^H_{R_H R_H}\right|} = \frac{(\theta/2)\left[p_{HF}(R_H + R_F) + p_H + p_F\right]}{\left|(\theta/2)\left[p_{HH}(R_H + R_F) + 2p_H\right] - 1/R_{H,aut}\right|}, \tag{35}$$

$$\frac{dR_F(R_H)}{dR_H} = \frac{\Pi^F_{R_F R_H}}{\left|\Pi^F_{R_F R_F}\right|} = -\frac{(\theta/2)\left[p_{HF}(R_H + R_F) + p_H + p_F\right]}{\left|(\theta/2)\left[-p_{FF}(R_H + R_F) - 2p_F\right] - 1/R_{F,aut}\right|}. \tag{36}$$

Thus, reaction functions have opposite sign, formally $sign\left(\frac{dR_H(R_F|\cdot)}{dR_F}\right) = -sign\left(\frac{dR_F(R_H|\cdot)}{dR_H}\right)$. We also have that:

$$\frac{dR_H(R_F)}{d\theta} = \frac{\Pi^H_{R_F,\theta}}{\left|\Pi^H_{R_H R_H}\right|} = \frac{(1/2)\left[p_H(R_H + R_F) - (1-p) - 1\right]}{\left|(\theta/2)\left[p_{HH}(R_H + R_F) + 2p_H\right] - 1/R_{H,aut}\right|}, \tag{37}$$

$$\frac{dR_F(R_H)}{d\theta} = \frac{\Pi^F_{R_F,\theta}}{\left|\Pi^F_{R_F R_F}\right|} = \frac{(1/2)\left[-p_F(R_H + R_F) - p - 1\right]}{\left|(\theta/2)\left[-p_{FF}(R_H + R_F) - 2p_F\right] - 1/R_{F,aut}\right|}. \tag{38}$$

An interior equilibrium (R_H^*, R_F^*) is then identified by the equation:

$$\{1 + (\theta/2)\left[-p_F(R_H(R_F^*) + R_F^*) - p - 1\right]\} - \frac{R_F^*}{R_{F,aut}} = 0, \tag{39}$$

together with $R_H^* = R_H(R_F^*)$. The above condition is obtained by replacing H's reaction function

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$R_H(R_F)$ obtained from (14) into (15). It is useful to consider the slope of (39) with respect to R_F. To do so, rewrite (39) as $\Pi_{R_F}^F(R_H(R_F), R_F) = 0$. By exploiting (35) and (36), the derivative of the left hand side of (39) with respect to R_F is found to be equal to:

$$\left|\Pi_{R_F R_F}^F\right| \frac{dR_F(R_H)}{dR_H} \cdot \frac{dR_H(R_F)}{dR_F} + \Pi_{R_F R_F}^F < 0.$$

The above inequality holds because the two reaction functions have opposite slopes, namely $\frac{dR_F(R_H)}{dR_H} \cdot \frac{dR_H(R_F)}{dR_F} < 0$, and because at an interior optimum the problem is concave, namely $\Pi_{R_F R_F}^F < 0$. This implies that if Equation (39) is ever fulfilled, there is a unique equilibrium value of R_F^* equilibrium exists, it is also unique. To ensure existence, it must also be the case that $\Pi_{R_F}^F(R_H(0), 0) > 0$ and $\Pi_{R_F}^F(R_H(A_m - A_h), A_m - A_h) < 0$, together with the concavity of the rulers' objective functions. ∎

Proof of Corollary 0. We now prove the following comparative statics properties of the model. If an interior equilibrium (R_H^*, R_F^*) exists, it features the following properties:

1) A lower c_J increases equilibrium reform R_J^* in country J.

2) If country J is the aggressive reformer, namely $\frac{dR_J(R_{-J}|\theta, R_{J,aut})}{dR_{-J}} > 0$, then a marginal drop in c_J decreases reform R_{-J}^* in country $-J$ while a marginal drop in c_{-J} increases reform R_J^* in country J.

To prove these comparative statics, let us differentiate the rulers' first order conditions with respct to reform costs. We then obtain:

$$\Pi_{R_H R_H}^H dR_H + \Pi_{R_H R_F}^H dR_F = R_H dc_H, \tag{40}$$

$$\Pi_{R_F R_H}^F dR_H + \Pi_{R_F R_F}^F dR_F = R_F dc_F. \tag{41}$$

By solving the linear system it is easy to see that:

$$dR_H = -\varphi R_H dc_H - \varphi \frac{\Pi_{R_H R_F}^H}{\left|\Pi_{R_F R_F}^F\right|} R_F dc_F, \tag{42}$$

$$dR_F = -\varphi \frac{\left|\Pi_{R_H R_H}^H\right|\left|\Pi_{R_F R_F}^F\right|}{\left|\Pi_{R_F R_F}^F\right|^2} R_F dc_F + \varphi \frac{\Pi_{R_F R_H}^F}{\left|\Pi_{R_F R_F}^F\right|} R_H dc_H \tag{43}$$

where $\varphi = \frac{\left|\Pi_{R_F R_F}^F\right|}{\left|\Pi_{R_H R_H}^H \Pi_{R_F R_F}^F\right| + \left|\Pi_{R_H R_F}^H \Pi_{R_F R_H}^F\right|} > 0$. Clearly, $\frac{dR_H}{dc_H} < 0$, $\frac{dR_F}{dc_F} < 0$, and $\frac{dR_H}{dc_F} < 0$ if and

only if $\frac{dR_H(R_F)}{dR_F} > 0$, and $\frac{dR_F}{dc_H} > 0$ if and only if $\frac{dR_H(R_F)}{dR_F} > 0$. ∎

Proof of Proposition 2. In this and the remaining proofs, we will always replace the marginal cost of reform c_J with its counterpart $1/R_{J,aut}$. When $\gamma = 1$ from the reaction functions we obtain:

$$R_J^* = \left(\frac{1 - 3\theta/4}{1 - \theta\lambda R_{J,aut}} \right) \cdot R_{J,aut}, \tag{44}$$

which a maximum provided $\theta < \widehat{\theta} \equiv 1/\lambda \max_J R_{J,aut}$. We will always consider the case where θ is sufficiently low that in the range of variation of λ of interest [the one where not all countries have fully centralized, formally $\min_J R_J^* < R_c$] the condition is always met. We also focus on the case where the probability of either ruler winning is interior, which is guaranteed by the condition $\lambda(\max_J R_J^* - \min_J R_J^*) < 1/2$. This is equivalent to;

$$2\lambda(1 - 3\theta/4)(\max_J R_{J,aut} - \min_J R_{J,aut}) \leq (1 - \theta\lambda R_{H,aut})(1 - \theta\lambda R_{F,aut}), \tag{45}$$

which we also assume by focusing on similar country pairs (i.e. where $\max_J R_{J,aut} - \min_J R_{J,aut}$ is small). If the two countries are sufficiently similar, condition (45) is fulfilled for all λ. The remining properties then follow by inspection of the first order condition. ∎

Proof of Proposition 3. By a suitable choice of nonnegative coefficients $(\alpha_1, \alpha_2, \alpha_3, \alpha_4)$ we can write Equations (20) and (21) in matrix form as:

$$\begin{pmatrix} 1 & -\alpha_2 \\ \alpha_4 & 1 \end{pmatrix} \begin{pmatrix} R_H^* \\ R_F^* \end{pmatrix} = \begin{pmatrix} \alpha_1 \\ \alpha_3 \end{pmatrix}.$$

Using Cramer's rule, the solution to the system is:

$$R_H^* = \frac{\alpha_1 + \alpha_2\alpha_3}{1 + \alpha_2\alpha_4}, \quad R_F^* = \frac{\alpha_3 - \alpha_1\alpha_4}{1 + \alpha_2\alpha_4}.$$

This implies that:

$$\frac{R_H^*}{R_F^*} = \frac{\alpha_1 + \alpha_2\alpha_3}{\alpha_3 - \alpha_1\alpha_4}.$$

After some manipulation, the above equation can be written as:

$$\frac{R_H^*}{R_F^*} = \frac{R_{H,aut}}{R_{F,aut}} \cdot \frac{1 + \theta\lambda R_{F,aut}(1 - 2\gamma)}{1 - \theta\lambda R_{H,aut}(2 - \gamma)}. \tag{46}$$

The other properties immediately follow by inspection. ∎

Proof of Proposition 4. Equations (12) and (13) imply that:

$$W_J(\pi_J, B_J) = \max_{R_J} \; \theta \cdot \left\{ p_J(\widetilde{R}_J, \widetilde{R}_{-J})(\widetilde{R}_J + \widetilde{R}_{-J}) - 2\widetilde{R}_J \right\} + 2\widetilde{R}_J - \frac{\widetilde{R}_J^2}{\widetilde{R}_{J,aut}},$$

where $p_J(\widetilde{R}_J, \widetilde{R}_{-J})$ is the probability with which the ruler of country J wins the war. By the envelope theorem:

$$\frac{dW_J(\pi_J, B_J)}{d\pi_J} = \frac{\left(\widetilde{R}_J^*\right)^2}{\widetilde{R}_{J,aut}} \cdot \frac{2 - (1 - \pi_J) - 2P_d/R_c}{[P_d/R_c - \pi_J](1 - \pi_J)},$$

It is then easy to see that :

$$\left. \frac{\partial W_H}{\partial \pi_H} \right|_{\pi_H = \pi} > \left. \frac{\partial W_F}{\partial \pi_F} \right|_{\pi_F = \pi} \Leftrightarrow \left(\frac{\widetilde{R}_H^*}{\widetilde{R}_F^*} \right)^2 > \frac{\widetilde{R}_{H,aut}}{\widetilde{R}_{F,aut}}. \tag{47}$$

∎

Proof of Corollary 2. By inspection and using the notions developed in the Proof of Proposition 2. ∎

Proof of Proposition 5. Under the linear-symmetric contest success function, (30) can be rewritten as:

$$\left[\frac{1}{2} + \lambda(R_H^* - R_F^*) \right] \cdot \sigma \cdot (R_H^* + R_F^*) \geq R_H^*, \tag{48}$$

$$\Leftrightarrow \quad \lambda\sigma \left[(R_H^*)^2 - (R_F^*)^2 \right] - (1 - \sigma)R_H^* \geq \frac{\sigma(R_H^* - R_F^*)}{2}. \tag{49}$$

Given the symmetry of the contest success function, (49) can be used to study under what conditions does the stronger or weaker ruler wish to initiate a war.

Suppose in fact that H is the stong ruler, namely $R_H^* > R_F^*$. Then (49) becomes:

$$\lambda\sigma(R_H^* + R_F^*) - (1 - \sigma)\frac{R_H^*}{R_H^* - R_F^*} \geq \frac{\sigma}{2}. \tag{50}$$

Given the dependence of (R_H^*, R_F^*) on λ in Proposition 2, it is easy to see that the left hand side increases in λ over the range where $R_H^*, R_F^* < R_c$. Define λ^* as the sensitivity at which $R_H^* = R_c$. Then, if $\lambda^* R_c > 1/2$ there exists a $\widehat{\sigma} < 1$ such that, for $\sigma \geq \widehat{\sigma}$, there exists a $\lambda_1 < \lambda^*$ such that for $\lambda \geq \lambda_1$ condition (50) is met. If $\lambda^* R_c < 1/2$ or $\sigma < \widehat{\sigma}$, then set $\lambda_1 = \lambda^*$. Clearly, even though $\lambda_1 < \lambda^*$, for $\lambda > \lambda^*$ the distance $R_H^* - R_F^*$ becomes smaller and smalle, so that at some point,

when λ becomes large, (50) is violated.

Suppose now that F is the weak ruler, namely $R_H^* < R_F^*$. Then (49) becomes:

$$\lambda \sigma \left(R_F^* + R_H^*\right) + (1 - \sigma)\frac{R_H^*}{R_F^* - R_H^*} \leq \frac{\sigma}{2}. \tag{51}$$

Given the dependence of (R_H^*, R_F^*) on λ in Proposition 2, it is easy to see that the left hand side decreases in λ over the range where $R_H^*, R_F^* < R_c$. When $\lambda = 0$, the value of the left hand side is finite. As a result, there exists a $\widehat{\widehat{\sigma}} < 1$ such that, for $\sigma \geq \widehat{\widehat{\sigma}}$, there exists a λ_0 such that for $\lambda \leq \lambda_0$ condition (51) is met. For $\sigma < \widehat{\widehat{\sigma}}$, set $\lambda_0 = 0$.

We thus have seen that in $\lambda \in [0, \lambda_0] \cup [\lambda_1, \lambda^*]$ war occurs for sure and the optimal fiscal investments of Propositions 2 indeed characterize the full equilibrium. Suppose now that we are in $\lambda \in (\lambda_0, \lambda_1)$. Here our goal is not to fully derive the mixed strategy equilibrium but describe how the equilibrium works. In this range, at the fiscal investments of Proposition 2, countries have no incentive to go to war. How is an equilibrium determined in this case? Suppose first that for $\lambda \in (\lambda_0, \lambda_1)$ the equilibrium probability of war is $\omega = 0$. In this case, countries go back to the autarky investments $(R_{F,aut}, R_{H,aut})$. If at these investments no country has an incentive to go to war, then the equilibrium is one where for $\lambda \in (\lambda_0, \lambda_1)$ war does not occurs and country behave as in autarky. It is easy to check that if this is the case, then $\lambda_0 = 0$. The logic is that, again by Proposition 2, state building (and asymmetry among countries) fall in λ. As a result, if no ruler has an incentive to fight in autarky, when $\lambda = 3/4R_{J,aut}$, a fortiori no ruler has any incentive to fight for $\lambda = 0$, for in this latter case countries are even more equal. In sume, if $\omega = 0$, war only arises for $\lambda \in [\lambda_1, \lambda^*]$.

If instead at the autraky investments either ruler has an incentive to go to war, then in equilibrium the probability ω of going to war must be positive. Crucially, since autarky revenues are too high (and unequal) to avert war, it must be that a positive probability of war $(\omega > 0)$ *reduces* state building in the two countries, much in the spirit of Proposition 2 for $\lambda < 3/4R_{J,aut}$. From an ex-ante standpoint, an overall probability of going to war of $\theta\omega$ induces (according to Proposition 2) optimal investments $[R_F^*(\lambda, \omega), R_H^*(\lambda, \omega)]$. The equilibrium is then reached by setting ω such that, at the equilibrium probability of H winning $p(R_F^*(\lambda, \omega), R_H^*(\lambda, \omega))$, the party who at autarky revenues is willing to attack is just indifferent between attacking or not (and thus willing to mix with probability ω). ∎

Appendix 2: Power Contest Success Function

We now study the model under Equation (10). We focus on the case where the two countries are equally sized, namely $L_H = L_F$. This implies that:

$$p(R_H, R_F) = \frac{R_H^\lambda}{R_H^\lambda + R_F^\lambda}. \tag{52}$$

When $\lambda = 0$ the war outcome is determined by a coin toss, i.e. $p = 1/2$. When $\lambda = 1$ a country wins the war with odds equal to its relative fiscal revenue. When $\lambda \to \infty$ the richer country wins for sure. By plugging Equations (11) and (52) into Equations (14) and (15) it is easy to find:

Lemma 2 *When countries are symmetric, $R_{F,aut} = R_{H,aut} = R_{aut}$, the equilibrium is interior and unique. In this equilibrium, we have that:*

$$R_H^* = R_F^* = R_{aut} \left[1 + \frac{\theta}{4}(\lambda - 3) \right]. \tag{53}$$

Higher θ boosts state building relative to autarky if and only if the sensitivity of the war outcome to fiscal revenues is sufficiently high, namely $\lambda > 3$.

Suppose now that $\lambda \leq 1$. then, if countries are asymmetric, namely $c_H \neq c_F$, in an interior equilibrium we have that $R_H^* > R_F^*$ if and only if $c_H < c_F$.

Proof. By using $|\partial p(R_H, R_F)/\partial R_J| = \lambda \cdot p(1-p)/R_J$, (52), the first order conditions become:

$$\begin{aligned}
R_H^* &= R_{H,aut} \cdot \left\{ 1 + (\theta/2) \left[\lambda \cdot p(1-p)\frac{R_H^* + R_F^*}{R_H^*} - (1-p) - 1 \right] \right\}, \\
R_F^* &= R_{F,aut} \cdot \left\{ 1 + (\theta/2) \left[\lambda \cdot p(1-p)\frac{(R_H^* + R_F^*)}{R_F^*} - p - 1 \right] \right\}.
\end{aligned}$$

When $R_{H,aut} = R_{H,aut} = R_{aut}$ the equilibrium is symmetric, $p = 1/2$, so that:

$$R_H^* = R_F^* = R_{aut} \left[1 + \frac{\theta}{4}(\lambda - 3) \right]. \tag{54}$$

At a symmetric equilibrium, the rulers' objectivves are concave, so (54) is indeed an optimum. To see this, consider the concavity of H. In the case of the power function (52), the second order condition (33) becomes:

$$(\theta/2)\frac{\lambda p(1-p)}{R_H} \left[\frac{(1-2p)\lambda - 1}{R_H}(R_H + R_F) + 2 \right] - c_H < 0.$$

It is immediate to see that at a symmetric equilibrium the teerm in square bracket becomes equal to zero, so that the second order condition is fulfilled.

Consider now the asymmetric case where $c_H \neq c_F$. In this case, one can show that an interior equilibrium exists provided θ is sufficiently small and c_J is sufficiently large for $J = H, F$. In this case, we know from Equations (14) and (15) that in equilibrium we have:

$$c_H = \frac{1 + \frac{\theta}{2}\left[\frac{\lambda p(1-p)}{R_H}(R_H + R_F) - 2 + p\right]}{R_H} \tag{55}$$

$$c_F = \frac{1 + \frac{\theta}{2}\left[\frac{\lambda p(1-p)}{R_F}(R_H + R_F) - 1 - p\right]}{R_F} \tag{56}$$

When $c_H < c_F$, it must be that the right hand side of (55) is smaller than the right hand side of (56). After some algebra, one can show that this condition is equivalent to:

$$(R_H - R_F)\left(1 - \frac{\theta}{2}\right) + \frac{\theta}{2}\lambda p(1-p)\frac{(R_H + R_F)^2}{R_H R_F}(R_H - R_F) + \frac{\theta}{2}[R_F(1-p) - R_H p] > 0.$$

One can check that for $\lambda \leq 1$ the above condition cannot be met if $R_H \leq R_F$. This implies that when $c_H < c_F$, in an interior equilibrium it must also be that $R_H > R_F$. $\blacksquare$

The main findings obtained under the linear specification are preserved under the exponential contest success function (52). In particular, the war threat ($\theta > 0$) boosts centralization if and only if λ is sufficiently large. Equation (53) formally proves this for the case where the two countries are identical because it is difficult to fully solve the case where countries are asymmetric under the power contest success function. It also continues to be the case that the external war threat exerts an asymmetric effect across countries, favouring the country, H, with a lower domestic cost of reform.