Education and Military Rivalry[*]

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Abstract

Motivated by historical evidence on the relation between military threats and expansions of primary education, we assemble a novel panel dataset from the last 150 years in European countries and from the postwar period in a large set of countries. We find empirically that (i) investments in education increase in response to military threats, (ii) democracy has a negative direct effect on education investments, and, (iii) education investments in better democracies respond more to military threats. These empirical results are robust and continue to hold when we instead exploit rivalries in a certain country's immediate neighborhood as an alternative source of variation. To help us interpret these patterns in the data, we develop a theoretical model which is consistent with the three empirical findings. The model has an additional prediction about investments in physical infrastructures, which we also take to the data.

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1 Introduction

What makes countries reform mass education? A common view is that educational investments are the flipside of democratic transitions. In this view, autocracy allows a ruling elite to secure its power by denying the masses access to education, while democracy – a wider franchise and/or open electoral competition – promote mass education. This idea might look quite as a quite convincing explanation for the history of educational reforms in Europe, starting with France. Indeed, Figure 1 (from Lindert, 2004) suggests that public contributions to primary-school education rose sharply in 1880, once France had completed its transition from the Second Empire to the Third Republic, a clear move towards greater democracy.

Figure 1 about here

However, another event precipitated the fall of the Second Empire, namely France's defeat against Germany in the 1870 Battle of Sedan. In the words of Lindert:

> "The resounding defeat by Prussia tipped the scales in favor of the education reformers. Enrollments and expenditures accelerated across the 1870s, with local taxation leading the way. The real victory of universal tax-based education came with Jules Ferry's Laic Laws of the 1880s, especially the 1881 law abolishing all fees and tuitions charges in public elementary schools.[...]While national politics could not deliver a centralized victory for universal schooling before the military defeat of 1870 [...] after 1881 centralization performed the mopping up role" (Lindert, 2004, p. 112)

Eugene Weber's research on the modernization of rural France between 1870 and 1914 suggests why military threats may spur centralized investment in mass education (Weber, 1979). A highly disintegrated population, which was largely illiterate and spoke a multiplicity of dialects, was to be transformed into a unified people sharing a set of patriotic values, a spoken and written language, an array of moral principles, and a motivation and ability to defend France in future conflicts[1].

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[1] As Leon Gambetta would say to the leader of the Breton forces: "I beg you to forget that you are Bretons, and to remember only that you are French".

In this paper, we study historical panel data on education spending and enrollment – for a subset of mostly European countries since the 19th century and a much larger sample in the postwar period – to assess the correlation between military rivalry (war risk) and enrollment in primary education (occurrence of educational reforms). Standard panel regressions reveal that, conditional on country and year fixed effects, primary education is positively and significantly associated with military rivalry or recent involvement in an external war. As for the political regime, the estimated coefficient on democracy (gauged by the Polity IV index) comes out negative when we control for military rivalry, while the interaction between the two variables is typically positively and significantly associated with education. The coefficient on military rivalry remains stable when we control for the political regime, suggesting that military threats are independently related to mass education.

To address appropriate concerns about endogeneity, we consider rivalries between a country's bordering countries and third countries as an exogenous source of variation. This rests on the idea that a country is more likely to perceive military threats when military rivalries arise in its neighborhood. When we regress a country's primary education on the rivalries among its neighbors, the reduced-form results are qualitatively similar to the OLS results. Running the corresponding IV specification, we again find a positive and significant effect of rivalry, a negative direct effect of democracy, and a positive and significant interaction term between the two. Overall, the empirical results suggest a causal relationship from rivalry to primary enrollment.

Our paper speaks to, at least, three strands of research. On the relationship between public-education investments and democracy, Lott (1999) suggests that non-democracies could invest more than democracies in public education as a means of indoctrination. On the other hand, Glaeser et al. (2007) argue that education and democracy should be positively correlated, as civic participation – needed to support transitions from dictatorship into democracy – is positively related to education. But the evidence for a positive relationship between education and democracy is mixed. Mulligan, Gil, and Sala-i-Martin (2004) present cross-country evidence indicating that more democratic countries do not have higher levels of social expenditures and, in particular, higher public education spending. More recently, Murin and Wacziarg (2014) find that education fosters democratization, but no evidence of causality in the reverse direction from the political regime to education attainment. Bursztyn (2014) shows that poor voters in Brazil prefer the government to carry out cash transfers, which yield immediate income,

rather than vesting resources into public primary education. Also related to our analysis is Bourguignon and Verdier (2000), who develop a model to explain why the ruling class may sometimes invest in education even though schooling enhances political participation. Analogously, Galor et al (2006) theoretically argue that capital accumulation gradually intensifies the importance of skilled labor in production and therefore generates support in the ruling class for human-capital investment. Galor et al. (2009) maintain that a higher concentration of land ownership typically discourages the development of human capital enhancing institutions, in particular schooling. Based on data for 27 countries and 70 years from 1870, Ansell and Lindvall (2013) find that observed educational reforms reflect the resolution of conflicting interests not only in politics but also in religion. However, no paper in this strand of research looks at the effect of military threats in democracies and autocracies.

A second related literature deals with the impact of wars on economic and political outcomes. On the latter, Ticchi and Vindigni (2009) analyze theoretically a mechanism whereby international conflict may trigger democratic transitions. Their modeling is motivated by a large amount of earlier research in political science and political sociology, such as Giddens (1985), and empirical facts presented by Dolman (2004). Another research tradition on the economic impact of wars starts with Anderton and Carter (2001), Blomberg and Hess (2006), and Glick and Taylor (2005). More recent research by Martin, Mayer and Thoenig (2008a,b) and by Acemoglu and Yared (2009) evaluates the extent to which wars reduce trade flows. However, this research does not generally investigate the links between wars and investment in education.

A third strand of work deals with state capacity. Hintze (1975) and Tilly (1975), preceding many others, provide historical accounts on the importance of wars for state building. A later economic literature, summarized and extended in Besley and Persson (2011), considers theoretically investments in fiscal and legal capacity, and finds positive correlations between past wars and current state capacity in international panel data. Thies (2004), using the same rivalry measure that we use, shows that military rivalries raise fiscal capacity in postcolonial developing states. Scheve and Stasavage (2011) investigate the links between wars, democracy, and estate taxation in about 20 countries since 1816 and find that democracy does not systematically influence top rates of estate taxation, whereas wars with mass mobilizations significantly raise these rates. Analogously, we find a robust correlation be-

tween current educational investments and past wars or military rivalry, while the correlation between wars and democracy is more tenuous. In addition, we find that military rivalry affects educational investment more in democracies than in autocracies, a finding that may be quite specific to education. In contrast to this literature, we treat state capacity as exogenous, both in the theory part and in our empirical analysis. More recently, Alesina and Reich (2015) analyze how policies of nation-building, in particular education, can help homogenize a country's population. They highlight two channels: a soft channel, facilitating communication among citizens with different languages and cultures, and a coercive channel, prohibiting local cultures. Alesina and Reich argue that democracies and non-democracies differ with respect to how much to invest in homogenization as well as how much to use the coercive channel. But they do not link policies of nation building to military threats, nor to its interplay with democracy.

We have organized the paper as follows. Section 2 describes three historical examples that speak to the relationship between military rivalry and education reforms. Section 3 introduces our data, descriptive statistics, and empirical specifications. Section 4 presents the econometric results and discusses their robustness to a variety of factual and statistical concerns. Section 5 spells out a theoretical model, which is consistent with three key empirical findings – in addition, the model has an auxiliary prediction, which also finds support in the data. Section 6 concludes.

2   Lessons From History

While each nation's history has unique elements that cannot be forced into a unified framework, the examples of France, Japan, and China over the 19th century show how military threats or rivalries can spur educational reforms. Moreover, Japan and especially China illustrate the point that military threat – more than democracy *per se* – may be the main driving force behind school enrollment, while comparing France and China suggests that this driving force may be enhanced by democracy. In these examples, we give a background on the historical context, on the domestic debate in a volatile international environment, on the subsequent process of education reforms, and on outcomes especially with regard to primary enrollment.

2.1 Jules Ferry and the French Third Republic

Background and Debate   In 1870, French public expenditures on education were lagging behind those of Prussia and other European countries, due to an education system that was mainly private and largely religious. Teaching was done by priests or anyone who knew how to read, often in improvised classrooms with poor amenities in the backyard of a farm. A large fraction of registered children never attended school. The result was a population with many illiterate or unable to understand a text. In 1863, 7.5 million citizens (about a fifth of the population) spoke only local dialects and no proper French.

Even prior to the Prussian war in 1870, elites knew that French education had failed to promote national unity. Appointed Minister of Education in 1863 by Napoleon III, Victor Duruy was advocating sweeping educational reforms, better educational facilities, and more of technical education – plans similar to those Jules Ferry would pursue some 20 years later. But Duruy did not manage to gather enough political support, especially from a rural population heavily influenced by the Church, so the emperor let his minister's project be defeated by the legislature.

In September 1870, Napoleon III was made prisoner at Sedan, and in February 1871 Germany took control of Alsace and Lorraine. This resounding defeat prompted the fall of the Second Empire. After the Sedan battle, the debate about educational reforms would continue. Conservatives and the church saw the defeat as a punishment for France's infidelity to its traditions, while progressives saw it as a reflection of superior Prussian schools and universities. However, the defeat spurred support for the reformers:

> "There was nearly universal belief among the French elite that Prussia had triumphed because of the superiority of its celebrated universities: a popular aphorism was that the University of Berlin was the revenge for the defeat at Jena. French praise for German education extended to all levels of the system. Journalists repeated the dicta that the Prussian elementary school teacher was the architect of Sedan and that the modern secondary education of the Realschulen had provided the scientific base for Prussian military efficiency." (Moody, 1978, p. 87).

Eventually, a majority agreed that education had played a key role in Prussia's rise to power and that French education had to be reformed, not

only to increase literacy, but also to give new generations basic knowledge in arithmetic, history and geography, and to

> "teach Frenchmen to be confident of their nation's superiority in law, civilization and republican institutions. It should be consistent with reigning social values, and thereby eliminate disruptive conflicts and promote the unity of the classes. Since France no longer enjoyed religious unity, it must forge a new moral unity from a unified education that would teach civic morality based on the principles of natural reason" (Moody, 1978, p. 88).

The Reform Process Jules Ferry became Minister of Education in February 1879 and came to play a key role in enshrining the principles of universal education. Thus he abolished all tuition in public elementary schools (in 1881), made enrollment compulsory from age six to thirteen (in 1882), made it mandatory for every village with more than twenty children at school age to host a public elementary school (in 1883), devoted subsidies to the building and maintenance of schools and to paying teachers (in 1885), and established an elementary teaching program, together with monitoring provisions (in 1886). These so-called "Laic Laws" still characterize today's French education system. At the same time, a supporting infrastructure program – the Freycinet plan – was to facilitate access to schools. Millions of francs were spent on road building to match the large amounts spent on schools: 17,320 new schools were built, 5,428 schools were enlarged, 8,381 schools were repaired (Weber, 1979). Enrollment and attendance in primary education steadily increased.

In addition to wider access, the reforms transformed the content of elementary education: new programs emphasized geography, history, and dictation. The new history and geography programs aimed at conveying patriotic values to new generations.[2] From their very first day at school, children were taught that their first duty was to defend the fatherland. Even gymnastics were meant "to develop in the child the idea of discipline, and prepare him [...] to be a good soldier and a good Frenchman" (Lindert, 2004).

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[2]As for dictations, they were useful to teach the French language but, beyond that "the exercise was a sort of catechism designed to teach the child that it was his duty to defend the fatherland, to shed his blood or die for the commonwealth, to obey the government, to perform military service, to work, learn, pay taxes and so on" (Lindert, 2004, p. 333).

Outcomes   Official statistics[3] attest that school attendance rose substantively in the decade after 1882. Primary enrollment rates went up from 12% of the population in 1870 to over 14% in 1912. Literacy rates rose from 80% in 1870 to 96% in 1912 (the initial 80% figure is partly misleading, as most "literate" children did not understand what they read). Finally, the reforms appear to have increased the sense of patriotism and national unity. Thanks to the Ferry laws,

> "in Ain, Ardennes, Vendee, all children became familiar with references or identities that could thereafter be used by the authorities, the press, and the politicians to appeal to them as a single body" (Lindert, 2004, p. 337).

In that respect, Ferry's efforts paid off during the subsequent mobilization in 1914.

2.2   Japan in the Meiji Era

Background and Debate   From the 17th century, Japan was ruled by military lords (so-called *shoguns*) of the Tokugawa dynasty. Education was a privilege of the Samurais and centered on tradition and the study of Confucian classics. From the mid 1850s though, Japan came under threats by Western powers. In 1853, US Commodore Matthew Perry presented an ultimatum: open up to trade or suffer the consequences of war. To add credibility to this threat, American warships were sent to Japan and the Trade Convention of Kanagawa was signed in March 1854. Western threats towards Japan in the second half of the 19th century acted as a catalyst for educational reforms:

> "In 1872, government leaders were haunted by a crisis of international proportions. [...] European colonial empires had spread into the Far East, threatening the very existence of Japan as a sovereign state. During the years of self-imposed isolation by the Tokugawa regime [...], the country had fallen dangerously behind the West as the industrial revolution got under way. The rise of Western capitalism and international colonialism posed a pervasive threat to Japan, as perceived by the new leaders. They were

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[3]As reported in Moody (1978) and Lindert (2004).

determined to use any means necessary to transform their country into a modern state in order to preserve the political order and the national sovereignty. Education on the Western model was envisioned as an instrument to achieve that goal." (Duke, 2009, p. 1).

The Tokugawa implemented various reforms in the early 1860s, but did not go far enough to satisfy the Samurais. Japan fell into civil war and in January 1868, the insurgents prompted Emperor Meiji, who had just taken the throne, to announce an "imperial restoration".

After this coup d'Etat, a debate emerged about education. Some wanted to preserve the focus on Confucian classics to maintain interpersonal hierarchical relationships and traditional customs, while others favored introducing secular Western science, mathematics and rationalistic thought to modernize the Japanese society. The progressives eventually prevailed over the traditionalists. Indeed, "observation of European and American societies convinced leaders such as Kido Koin that mass schooling, like mass conscription, was a fundamental source of the economic and military power of the West. Their initial models were primarily American and French" (Gordon, 2003, p. 67). The newly founded Ministry of Education sent delegates to learn about Western education systems, for instance with the Iwakura mission of 1872-1873.

The Reform Process Thus, the Meiji-era leaders decided on profound reforms of mass education to meet the challenges from the West: "mass compulsory education was a bold initiative, and a risky one for the government" (Gordon, 2003, p. 67). They could have decided to hold back from imparting literacy and potentially subversive "enlightenment" to imperial subjects who were expected to follow orders. But the leaders consciously took this risk, concluding that an ignorant populace would be a greater threat to their project of building political and economic power. Thus, military threats was a clear driver of educational institutions. As Burnett and Wada (2007) argued,

"For the first time in Japanese history education was interpreted as a tool in the push to modernize the nation, a point confirmed by the then Minister of Education Mori Arinori: 'Our country must move from its third class position to second class, and from second class to first: ultimately to the leading position among all

countries of the world. The best way of doing this is [by laying] the foundations of elementary education'."

The desire to unify the people after years of civil war and the sense of urgency derived from perceived domestic and foreign threats explains the radical reforms by the Meiji leaders. They approached education as an instrument to serve the state and were eager to follow what they called the "Prussian notion of education" (Duke, p. 314).

Accordingly, in 1872 a new education system demanded four years of compulsory elementary education for all children. As explained by Burnett and Wada (2007), "in just a one-year period following the Gakusei of 1872, 12,500 primary schools were established. Within the next five years the number of schools doubled to a figure not surpassed until the 1960s." The move to mass education was completed by a national training system for teachers. The first teacher's college was created in Tokyo in July 1872, based on American principles of elementary-school instruction.

Outcomes   Initially, reactions to the educational reform were mixed.

"Not everyone was so happy at the obligation to attend school [...] In the 1870s, angry taxpayers reacted to compulsory schooling as they had to the draft: they rioted. Crowds of people destroyed at least two thousand schools, usually be setting them afire. [...] The passive resistance of simply not going to school was even more widespread. Rates of attendance for school-age boys and girls stood at 25 to 50 percent of the eligible population for the first decade of the new system" (Gordon, 2000, p. 68).

One might argue that popular resistance reflected a lack of democracy: peasants neither identified with the emperor, nor with the new ruling class, and therefore disapproved of the new compulsory nationalistic education. Similarly, people at first tried to resist the military reform.

Yet, over time, the reforms became a resounding success. Japan overtook most European powers with regard to primary enrollment per school-age child, which rose from 28% in 1873 to 98% in 1910. From 1865 to 1910, the literacy rate increased from 35% to 75% for men and from 8% to 68% for women.[4].

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[4]See Gordon (2000) and Duke (2009)

Successful education reforms certainly played a role in Japan's unexpected military victories in the 1895 war against China and the 1905 war against Russia. Overall, the Meiji-era reforms further illustrate the idea that education reform occur as a result of strategic military concerns. The Japanese example is probably even clearer than the French one, in that military considerations clearly took precedence over humanistic ones. Yet, the initial popular resistance may illustrate how a lack of democracy can reduce or delay the effectiveness of educational reforms.

2.3   China and the Hundred Days' reform

Background and Debate   19th century China offers yet another illustration how military threats can prompt educational reforms. But it also illustrates that such reforms may be fragile in the absence of democracy, and thus the complementary roles of military rivalry and democracy in fostering educational enrollment. Throughout that century, China debated how to reform its education system (notably the civil-service examination) to incorporate the study of modern science into traditional curricula. The hope was that such reform would give China the power to stand up to Western colonizers. This debate culminated during the Hundred Days' Reform, although that education reform was eventually abandoned.

In the first half of the 19th century, the geopolitical situation of China was very similar to that of Japan. The Middle Kingdom was forced to open itself to Western powers. The Opium wars of 1839-1842 and 1856-1860 and the destruction of the old Summer Palace by British and French troops in 1860 attest to the delicate situation of China in the new global order. Many officials argued for adopting Western military technology and armament, and consequently advocated a qualitative shift in education, from the study of Confucian classics to modern science. But such a reform would threaten the established order – for centuries, the civil-service examination had been based on the teachings of Confucius and ensured that the ruling elite subscribed to a Confucian world view. The elites certainly knew that reforming education might result in "losing the soul of China" and – perhaps even more importantly – might imply great changes to social hierarchy.

Gradual Reforms   To the extent the Chinese elite pushed for educational reform, it did so gradually. One view was that Western military technology

could be mastered by establishing shipyards and arsenals and by hiring foreign advisers. Arsenal schools – first established in the 1860s by the Qing government – provided applied training in Western science and engineering and produced Chinese-language translations of important books in the natural and applied sciences (Cantoni and Yutchman, 2011). These reforms were part of the so-called "self-strengthening movement" and relied on the conviction that China would learn from foreigners, catch up with them, and finally surpass them.

This conviction was challenged by the unexpected defeat to Japan in 1895. It seemed that China needed more than self-strengthening and the young Guangxu Emperor ordered a series of reforms to bring about sweeping social and institutional changes – a famous episode of Chinese history known as the Hundred Days' Reform. His advisers, notably Kang Yuwai and Liang Qichao, recommended a second stage of educational reforms, including a national-school system that would grant students degrees and would replace the Imperial examination system. Consequently, the Imperial University, also known as Beijing University, was founded in 1898. This university with its science-oriented curriculum was bound to have large repercussions on the whole education system: "This was not merely to be a university located in the capital, but the Imperial university, the new creator of intellectual standards and norms, the ultimate and official authority that trumped all education experiments at the local level" (Karl and Zarrow, 2002, page 110).[5]

Partial Reform Reversal In September 1898, a coup d'Etat was staged by conservative opponents led by Empress Dowager Cixi. 1898. The radical reformers were executed or forced into exile and the Empress Dowager overturned the Guangxu Emperor's ambitious reforms, with one significant exception. The Imperial University survived the coup, although with a modified curriculum: the pluralistic approach to knowledge was limited, imperial edicts would be studied more often, the birthdays of Empress Dowager and Guanxu Emperor would be observed, etc. In short, Empress Dowager's advisers designed "an institutional practice in which ritual observance of political loyalty played a central role" and "the Qing dynasty rose ever more

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[5]There was no doubt that "Liang Qichao's reform for the Imperial University proved terribly threatening to the conservative powers that be, who were unwilling to countenance the idea that the Chinese intellectual tradition, and by extension the source of their own power, was anything but sacred in nature" (Karl and Zarrow, page 113).

prominently into the sacred space they had formerly dominated." (Karl and Zarrow, page 117). Although Guangxu's reforms were overturned by the Empress Dowager, they served as a basis for other reforms which occurred a few years later, notably with the suppression of the Imperial examination system in 1905.

2.4   Summing Up

The histories of France, Japan and China illustrate how military threats and rivalries may help induce purposeful investments in education. Moreover, contrasting France with Japan, and especially with China, suggests that the educational reform triggered by a military threat may also depend on the political regime. In democratic France the reforms met with less initial resistance than in autocratic Japan and China, even if they eventually had a larger effect in Japan. To further explore this issue, we will look for interactions between democracy and military rivalry in the data.

A positive relationship between military rivalry and primary education enrollment could reflect different objectives of the rulers. These may include desires to (i) generate basic knowledge in mathematics or language, (ii) promote group discipline, or (iii) transmit patriotic values. Our empirical analysis in Section 4 will not be able to directly distinguish between these alternatives. The positive effect of military rivalry on primary education enrollment may also reflect the evolution of military technology over time: rivalries and wars existed long before the 19th century without inducing mass education reforms. But as industrialization came together with new technologies for modern warfare and more complex war strategies, this may have enhanced the value of educated soldiers. Our empirical analysis will indeed show that the positive correlation between military rivalry and education enrollment applies to countries reaching a minimum threshold level of industrialization.

3   Data and Empirical Specifications

3.1   Sources and Variable Definitions

Education   To empirically investigate the determinants of mass education reforms, we use an unbalanced panel with annual data for 166 countries

between 1830 and 2010. Our main dependent variable, $Enrollment_{i,t}$, measures primary enrollment per 10,000 inhabitants in country i and year t to accord with the established UNESCO definition. The underlying data are drawn from the CNTS Data Archive of Banks (2011). In our baseline regressions, we use primary enrollment as a continuous dependent variable. As it is constructed on a per-capita rather than per-school-age-child basis, this measure is affected by shifts in demographic structure: for the same prevalence of schooling, a young population will have a higher measured primary enrollment rate than an old population. We therefore control for population growth in the past 10 years to mitigate such effects. As shown by the descriptive statistics in Table 1, the average primary enrollment rate is 10.5% of the population over our pooled sample, with a large variation across countries and time periods.

To test the robustness of our results, we also analyze the probability of discrete education reforms expanding access to primary education.[6]

War Threats We measure military threats and war risk in two alternative ways. As in the historical examples, a recent experience of external conflict may raise the perceived likelihood of a new conflict and the salience of military concerns in policy decisions. *Recent war*$_{i,t}$ is a binary indicator set equal to one if country i was engaged in an external war in any of the 10 years prior to year t, according to the variable "inter-state war" in the Correlates of War (COW) database. This database also provides information on the outcome (victory or defeat) of past wars and a (crude) estimate of the number of casualties as a percentage of the pre-war population. For each country, we always exclude years of ongoing war from the sample, because wars – as opposed to latent rivalries – may severely increase the opportunity cost of public funds. Perhaps more importantly, data in times of war are likely unreliable.

This measure of war risk is, of course, completely backward-looking and may therefore miss emerging threats without any conflict history. Our core

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[6]For a reduced sample of 14 European countries (Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Norway, Sweden, Switzerland, and United Kingdom) over the period 1830 to 1975), a binary *reform* variable is set equal to one in years when any new law is passed, which extends compulsory education, lowers the cost of education (e.g., abolish school fees for primary education), or increases the number of schools (e.g., makes it compulsory for each municipality to set up at least one primary school). The source for this variable is Flora (1983). There are 52 such reforms in the sample.

measure, $Rivalry_{i,t}$, is less subject to this concern. This indicator picks up whether country i has a strategic rival in year t, according to Thompson (2001) and Colaresi et al. (2010). Rivalry captures the risk of armed conflict with a country of significant relative size and military strength, according to contemporary perceptions by political decision-makers gathered from historical sources on foreign policy and diplomacy. Specifically, military rivalries are identified by three criteria: whether two countries regard each other as "(a) competitors[7]; (b) a source of actual or latent threats that pose some possibility of becoming militarized; (c) enemies" (see Appendix A for details).[8] We also create a measure of the relative strength of rivals, assessing the probability of winning or losing a potential military conflict, by gauging the ratio of their respective armies. To this end, we draw military personnel numbers from the COW National Material Capabilities database.

The summary statistics in Table 1 confirm that Thompson's rivalry variable captures a wider range of situations that the past-war variable. The two are positively correlated, but less than perfectly so: 15% of the country-year observations in our sample are associated with a war in the previous 10 years, while over 70% are associated with one or more strategic rivalries. It should be noted that the sample for strategic rivalries is smaller as it only includes countries experiencing a rivalry at some point in their history since 1830 – the estimation therefore draws on the within-country variation over time in rivalries and enrollment. Among countries engaged in strategic rivalries, a war had materialized in the previous 10 years in 23% of the cases.

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[7] "Most states are not viewed as competitors – that is, capable of "playing" in the same league. Relatively weak states are usually capable of interacting competitively only with states in their immediate neighborhood, thereby winnowing the playing field dramatically. Stronger actors may move into the neighborhood in threatening ways but without necessarily being perceived, or without perceiving themselves, as genuine competitors. If an opponent is too strong to be opposed unilaterally, assistance may be sought from a rival of the opponent. Other opponents may be regarded more as nuisances or, more neutrally, as policy problems than as full-fledged competitors or rivals. [...] Actors interpret the intentions of others based on earlier behavior and forecasts about the future behavior of these other actors. The interpretation of these intentions leads to expectations about the likelihood of conflicts escalating to physical attacks. Strategic rivals anticipate some positive probability of an attack from their competitors over issues in contention." (Thompson, 2001)

[8] To our knowledge, the collection of data and coding of qualitative information conducted by Thompson (2001) and Colaresi et al. (2010) is the most rigorous and comprehensive on rivalries to date.

Political Regimes For the political regime, we use the institutionalized autocracy and democracy scores (the *polity2* variable) in the Polity IV database. These are themselves combinations of constraints on the executive, openness and competitiveness of executive recruitment, and competitiveness of political participation. The combined score $Democracy_{i,t}$ ranges from -10 to $+10$, where a higher score means that country i at date t is more democratic. About 43% of the country-years in our sample have positive scores. The mean score is -0.37 and the variance is 7.1, with strong variation both within and between countries: although political regimes often change slowly, about 36% of the total variance in democracy scores is due to the within component. One question in our empirical exercise is whether political change is an important driver of mass education beside external rivalry. Our results are all robust to using lagged democracy scores instead of current democracy scores (in order to mitigate endogeneity concerns).

Covariates Finally, our regressions include a number of other covariates. Military expenditures and total population are drawn from the COW National Material Capabilities, with additional data from the World Development Indicators (for the post-1960 period) and CNTS. As most series have a break in 1914, we include pre- and post-1914 military expenditure separately. Measures of GDP and government expenditures (per capita) are from the World Development Indicators and CNTS databases. Urbanization rates are drawn from the same sources and measure the share of population living in cities of over 100,000 inhabitants in our baseline regressions. We test the robustness of our results to thresholds of 50,000 and 20,000 inhabitants. Other covariates used in robustness checks are introduced in context below.

Table 1 about here

3.2   Empirical Specification

Our baseline econometric specification is:

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\begin{aligned}
Enrollment_{i,t} \ = \ & \alpha_0 + \alpha_1 WarRisk_{i,t} + \alpha_2 Democracy_{i,t} + \qquad\qquad (1) \\
& \alpha_3 WarRisk_{i,t} \cdot Democracy_{i,t} + \alpha_4 X_{i,t} + \nu_i + \delta_t + u_{i,t} \ ,
\end{aligned}
$$

where the variables multiplying α_1 to α_3 were introduced in the previous subsection. Our main parameters of interest are α_1, which captures the

predictive effect on enrollment of war risk faced by country i in year t, and α_3, which captures the interaction of war risk with the democracy index. As explained above, military threat means at least one strategic rival in year t – or a war in the past 10 years (i.e., between years $t-10$ and $t-1$). We also include a set of control variables $X_{i,t}$, country fixed effects ν_i, and year fixed effects δ_t. Hence, the effects we estimate are identified from the variation over time within countries of the right-hand side variables relative to their world average levels.

For inference, we report heteroskedasticity-robust standard errors in the main tables and text. As shown in Table W6 in the Online Appendix, our main estimates are robust to allowing for country-specific linear time trends in the error term and standard errors clustered at the country level over periods of 10 years.[9]

However, if we cluster over the entire length of the panel for each country, the main results cease to be statistically significant, unless we do not include our full set of controls or fixed effects (results available from the authors). This is not surprising, given the small number of countries available in our sample and the large set of controls and fixed effects included in our specifications. The fact that the results are robust to clustering over the entire length of the panel without control variables (but keeping the fixed effects), as well as to clustering at the country level over periods of 10 years, indicates that the results are not spuriously driven by patterns of serial correlation similar to those described in Duflo et al. (2004).

To further test the robustness of our results, we also estimate the probability of a discrete education reform using a linear probability model with

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[9]Doing this, we allow for arbitrary country-specific serial-correlation patterns at the 10-year frequency. In other words – conditional on the set of controls, fixed effects and country-specific linear time trends – we assume that the country-specific error term can be treated as independent across periods separated by more than 10 years

This is in the spirit of Duflo et al. (2004), who show that collapsing panel-data information into a "pre-" and "post" period, yields valid standard errors in a difference-in-difference specification with a *common* reform date. Our approach amounts to collapsing our panel data over 10-year periods in our difference-in-difference specification with *country-specific* reform dates (the results are also robust to clustering over a different duration, e.g. 5 years or 20 years).

Another rationale for 10-year period clustering by country is that much of the yearly data we have on education and population are effectively based on interpolation between censuses with 10-year intervals – this may induce serially correlated measurement error on that frequency

the same set of covariates.

Our main prediction is that α_1 should be positive, whereas we are more agnostic about the signs of α_2 and α_3. Although our tests are primarily based on correlations in the data, we also try to address latent endogeneity issues by considering rivalries in a country's neighborhood as an alternative source of variation. In that case, we look at reduced forms as well as full fledged IV-specifications.

4   Empirical Evidence

4.1   Baseline Results

Table 2 shows the results from our baseline estimation of (1) in the yearly panel, with primary enrollment rates as the dependent variable. All specifications include 10-year population growth, to account for varying shares of school-age children in total population, as well as military expenditure per capita, to control for the possibility that military spending may crowd out education spending. We also control for urbanization rates in order to net out the impact of modernization in general and the higher concentration of schools in cities. Indeed, we find that high population growth rates and high urbanization rates are consistently associated with higher primary enrollments. Military spending, holding constant external threats, has a positive coefficient before 1914 but a negative coefficient afterwards. One interpretation of this pattern is that military spending and education spending were two facets of state-building in the earlier period, but that – once a certain level of state capacity has been reached – limited fiscal capacity restricts the ability to invest in education if more effort is devoted to building an army.

Table 2 about here

In columns 1 through 3, military threats are measured by the presence of an ongoing military rivalry. Column 1 shows that primary enrollment is positively and significantly associated with military rivalries. The point estimate is sizeable: almost a third of one standard deviation in primary enrollment. Interestingly, the coefficient on the democracy score is negative and significant. At the same level of military threat, autocracies invest more in education than democracies. This finding runs counter to a simple median-voter view of mass-education reforms, which would predict education

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to be positively related to democracy. The coefficient on military rivalry is stable when we control for the political regime. This appears to contradict a view that rivalries only matter insofar as they foster political change and that democratization is really the main force behind expansions of primary enrollment.[10]

In column 2, our baseline specification, we add an interaction term to check if the impact of rivalries on educational investments differs by political regime. Here, we find that primary enrollment is more positively associated with military threats in democracies than in autocracies. The coefficient implies that being engaged in a strategic rivalry is associated with additional primary enrollment of 0.9% of the population in an autocracy with a Polity score of -6 (at the 33rd percentile of the distribution) and of 2.3% in a democracy with a Polity score of 3 (at the 67th percentile). Subsection 4.3 scrutinizes the democracy results in more detail.

Additional Covariates In column 3, we include two covariates that may affect investments in education. The relative strength of rivals is defined as the army size of any strategic rivals divided by the country's own army size. A higher value of this interaction variable signals a higher risk of losing a potential war. The point estimate suggests that countries with stronger rivals indeed have higher enrollment rates. We also control for total government expenditures per capita on a reduced sample which does not cover the earlier period. Our main results are unchanged, namely the presence of a strategic rival is associated with higher enrollment in primary education, and democracies have less primary education. This suggests that war threats may have an independent effect on education investments, aside from any indirect effect that may arise through investments in higher fiscal (state) capacity.

Past Wars vs. Rivalries Columns 4 to 6 of Table 2 present the same set of regressions, except that we replace military rivalry by the occurrence of a war in the past 10 years. Primary enrollment is positively correlated with this alternative military threat variable. Also, consistent with the results in

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[10]This result is consistent with Murtin and Wacziarg (2014) who find no causal relationship from democracy to primary schooling when they control for the level of development with GDP per capita and average education of the population. Murtin and Wacziarg however find a link from education to democratization. While our model is agnostic about this direction of causality, it is not inconsistent with it.

columns 1 to 3, autocracies invest more in education than democracies. However, the interaction term is now insignificant or only marginally significant in those specifications, as well as the severity of the recent war(s), measured by the number of casualties incurred by the country as a percentage of its pre-war population.

4.2   Plausibility Checks

The motive for investing in mass education in our narrative is that a more educated population is more effective at fighting wars. In this subsection we perform two plausibility checks, which support this narrative. The econometric results are collected in Table 3.

Education as a Means to Win Future Wars   A first test is to look at the relationship between education, rivalries and future wars. The first four columns of Table 3 show the results of fixed effects linear-probability regressions. In columns 1 and 2, the dependent variable is a binary indicator for breakout of war in the next 10 years. As expected, being engaged in a rivalry positively predicts future wars. The coefficient on primary schooling is also positive and significant, which provides additional evidence that governments that (rationally) foresee high war risk may increase education investments. Surprisingly, military expenditures are not found to be higher in the run-up to a war, once we control for rivalry.

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Table 3 about here

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In columns 3 and 4, the dependent variable is instead an indicator for *winning* the next war, conditional on a war breaking out in the next 10 years. In column 3, we only include as covariates primary enrollment, democracy and military expenditure per capita. Here, we do find that the probability of winning is positively and significantly associated with current education. Perhaps surprisingly, military expenditures are not significantly associated with the probability of victory. To control for asymmetries in military capabilities, column 4 includes the size of the military (per 1,000 inhabitants) also in the country's largest rival. As expected, we find that a larger army positively predicts victory, and a larger army in the rival increases the likelihood of defeat. Importantly, the coefficient on primary enrollment remains identical once we control for the mobilization of the population into the

<div align="center">20</div>

military. Together with the historical evidence in Section 2, these findings support the view that military threats spur investments in mass education in order to build more effective armies. No other covariate, including military expenditure, enters significantly in the regression for the outcome of future wars.

Military Threats and Military Expenditure As a second check that education investments are indeed driven by military concerns, we rerun our baseline fixed-effects OLS regression but replace education as the dependent variable with military expenditure as a ratio of either GDP or total government expenditure. As seen in columns 5 and 6 of Table 3, we find the same basic pattern for military spending as we did for primary education: a positive response to strategic rivalries and a higher response in less democratic countries.

4.3   Robustness

In this subsection, we describe the results of a series of further robustness checks. to save space, the tables with the econometric estimates underlying all these checks are available in the Online Appendix.

Education Reforms Instead of the continuous enrollment measure, we analyze the effect of military threats on the probability of discrete educational reforms – see Table W2. When studying the effect of military threats on *Known reforms,* which broaden access to primary or secondary education, we only study the subsample of 14 European countries for which these data are available since 1830. The results are weaker than in the baseline regressions, which is not surprising with such a small number of countries. In particular, we find no effect of democracy and of its interaction with rivalry. But our main findings still hold: a significant positive effect of rivalry in democracies (and rival's military strength) on the probability of observing a reform in primary (or secondary) education, once we control for the political regime. Finally, neither population growth nor urbanization or military expenditure show significant coefficients when democracy is included in the regression.

Industrialization and Urbanization Expansion of primary schooling and democratization are salient aspects of development. Another aspect

is the transition from an agricultural and rural society to an industrial and urban society. This may lead democracy to be correlated with industrialization and urbanization. If an educated military is more valuable in more industrialized countries, our interaction between rivalry and democracy may pick up this effect. In addition, if industrialization relies on higher human capital, manufacturers may want to lobby for education reform (Galor et al., 2009). To address these concerns, we add measures of industrial development and their interaction with rivalry as covariates to our baseline specification. Specifically, we use the share of industrial activities in GDP (available for 1946-2000), and variations of the urbanization measure with the share of population living in cities of 50,000 or more inhabitants, and the share of population living in cities of 20,000 or more inhabitants – see Table W3.

When doing so, our results on democracy are unchanged: the direct coefficient on *Democracy* is negative, its interaction with *Rivalry* is positive, and both are statistically significant except over the reduced time period for which the industry share of GDP is available. Moreover, as expected, more industrialized and more urbanized countries have higher rates of primary enrollment when only the direct effect is included. Interestingly, we do find that enrollment responds more to military threats in countries with a larger share of industrial activities and a larger share of urban population. For a country with a *Democracy* score of 0, the estimates in column 6 of Table W3 suggest that the effect of military rivalry on primary education becomes positive around a 15% share of population living in towns and cities (with lower thresholds for more democratic countries). For instance, primary enrollment would be predicted to be higher by 0.8% of the population where 25% of the population lives in cities (at the mean) and by 2.5% of the population where the urbanization rate reaches 43% (the mean plus one standard deviation); again with higher values for more democratic countries.

These findings may also shed light on the potential mechanisms behind our main result. Although we cannot test directly the three potential channels – acquisition of basic skills, group discipline, or patriotic values – the positive interaction terms between rivalries and industrialization support the skills channel. Rivalries and wars existed long before the 19th century – when group discipline or patriotism were presumably already valuable in armies – without triggering mass education reforms. But then industrialization has gone together with the development of technologies of modern warfare and more complex war strategies. These may have raised the value of educated soldiers, since an army mastering basic skills is more effective at fighting

modern wars. Our results should thus be interpreted as applying primarily to the era of modern warfare.

Additional Covariates and Sample Selection   We perform several other robustness tests on our baseline specification – see Table W4. We first include the index of ethnic fractionalization from Alesina et al. (2003), as well as its interaction with rivalry. Ethnic diversity has been shown to affect the amount of social spending and in particular education investment. We find that more fractionalized countries have lower enrollment rates, and the effect of rivalry on primary enrollment also decreases with ethnic fractionalization. Yet, our main coefficients remain unaffected.

Then, we include the primary enrollment rate of the rival. Consistent with our intuition, countries increase their enrollment rates more when their rivals have more educated populations, and therefore presumably more effective armies.[11]   Also, we add 10-year lagged enrollment to control for initial conditions. As expected, primary enrollment displays high serial autocorrelation, but our main coefficient of interest on rivalry is unchanged. We also check that our results do not reflect an entirely European story by excluding Western Europe from the sample. Again, our results are robust to this change, and the coefficients on rivalry actually increase.

Moreover, we account for the possibility that country-specific factors may vary nonlinearly over the sample period, by interacting country fixed effects with dummies for before and after 1950. Our main result on military rivalry does hold up.

Alternative Dependent Variable   We have performed other robustness tests as well – see Table W5. One is to compare our baseline results with those obtained with an alternative measure of education, namely education attainment from the Barro-Lee (2010) data set, available at five-year intervals for the postwar period only. We run the specifications in (1), using as the dependent variable the amount of primary education achieved by adults in the 15-19 age span at year $t+5$, starting in 1950. Since education attainment

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[11]Interestingly, the direct coefficient on rivalry turns negative when we control for the education of rivals, which suggests that facing weaker, less skilled potential enemies actually acts as a disincentive to invest in one's own primary education. However the overall effect of rivalry (for a rival of equal military size) turns positive at a fairly low level of the rival's enrollment, of around 750 per 10,000.

is defined per person of the relevant age group, we do not need to control for population growth in these specifications. We find similar results to those in Table 2 – a (weakly) positive effect of rivalry, a negative effect of democracy, and a positive interaction term. The results are somewhat weaker with the recent occurrence of an external war as the threat variable, but the positive effect of a recent war is significant. As previously mentioned, these results are robust to the inclusion of state-specific linear time trends.

4.4   The Political Regime

Our estimates imply that democratic countries invest less in primary education than autocratic countries, absent rivalries or war threats. However, the gap between democracies and autocracies narrows at high war threats. What might explain this pattern?

Possible Channels   Political institutions may affect education policy along several channels. As mentioned in the introduction, extending the franchise might foster pro-poor policies, like publicly funded primary schooling. But we find little evidence supporting this hypothesis. A prospective effect in the opposite direction is that leaders in democracies face stronger checks and balances. Therefore, they have higher turnover – and thus shorter expected time horizons – than autocrats, making the former less willing to invest in mass-education policies with mainly long-term benefits (see Besley, Persson and Reynal-Querol, 2015 on other effects of such a mechanism). A third channel could conceivably run through the effect of rivalries and wars on regime change: wars may affect education spending mainly because they promote regime change, which in turn affects education policy. However, our findings do not support this third channel, since the direct estimates of military rivalry on education remain unchanged when we control for the democracy score. Instead, our results suggest that war threats or past wars tilt the preferences of ruling elites towards mass education. Even if more schooling may raise the risk of autocratic leaders being ousted, the long gestation lags in education may push this threat too far into the future to affect current policy.

Disaggregating Democracy   But our empirical measure of democracy is very broadbrush, making it hard to understand the mechanisms at work. We

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therefore disaggregate the democracy score into its two main components: constraints on the executive and the openness of executive recruitment. In particular, the effective time horizon of political leaders may be best captured by the openness of executive recruitment, as this variable effectively measures how many prospective competitors can participate in the internal quest for power. Instead, constraints on the executive effectively measure the discretion of leaders and therefore how much of the gains from educational reforms they can appropriate.

We then run our main specifications, letting these two aspects of democracy enter separately on the right-hand side. To get a stronger signal, we define one dummy variable for each aspect: *High constraints on the executive* (*xconst* greater than or equal to 4 in the Polity IV database on a scale of 1 to 7, indicating at least substantial limitations on executive authority) and *Openness of executive recruitment* (*xropen* greater than or equal to 3 in the same database on a scale of 0 to 4, corresponding to the executive leader being appointed through competitive elections).

Table 4 reconsiders the effect on primary enrollment with military rivalry as the measure of war risk. The estimates in columns 1 and 3 show that executive openness is negatively correlated with the enrollment rate, while executive constraints are not. However, when we introduce interaction terms between rivalry and each specific aspect of democracy in columns 2 and 4, both direct effects are insignificant, while the interaction with rivalry is positive for executive constraints and negative for executive openness. In columns 5 and 6, we run a horse race between the two measures with or without interaction terms. The estimates show that the direct influence of each component of democracy and the interaction terms remain similar, albeit with a larger interaction term for openness of executive recruitment.

Table 4 about here

Thus, both aspects of democracy appear to matter in opposite directions.[12] When we take interaction effects into consideration, the direct relationship of both measures with primary schooling rates is not statistically significant, but in the presence of military threats, the relationship between high executive constraints, and primary schooling is consistently positive.

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[12]This is perhaps surprising in itself: various authors have pointed out that the Polity indexes do not display enough time variation to be significantly correlated with outcome variables such as income (e.g. Acemoglu, Johnson, Robinson and Yared, 2008).

Conversely, high openness of the executive recruitment, which gives executive leaders a lower stake in long-term investments, are associated with lower enrollment in the presence of rivalries. Overall the former effect dominates. The disaggregated results therefore shed some light on the mechanism whereby political regimes influence mass education: the critical institutions appear to lie in better accountability mechanisms and more constraints on the executive. These findings will guide our theoretical framework below.

4.5 Dealing with Endogeneity

We have found a positive relationship between military rivalry and primary education, as well as a positive relation between primary education and the interaction between rivalry and democracy. We have also found suggestive evidence that education helps improve military effectiveness in future conflicts. Finally, we have shown that our main results survive several plausibility and robustness checks.

However, one may still argue that our OLS regressions could suffer from reverse causality and/or omitted variables. For instance, a nationalist government that wants to strengthen national identity may simultaneously choose to educate its citizens to foster loyalty to the state, and create rivalries with other states to unite the nation. As another potential source of bias, a country that tries to become more internationally powerful might invest in education to increase its chances of winning future wars and subsequently feel strong enough to engage in rivalry with its neighbors. Thus, more powerful countries[13] may have better educated populations and engage in more rivalries, which would bias upwards the coefficient on rivalry in our OLS regressions for education. Conversely, the same OLS coefficient could be downward biased. For instance, a country with a weak state may have low levels of education, and other countries might decide to threaten it creating a military rivalry.

Estimating the causal effect of military rivalry on education outcomes is thus difficult, because rivalries as well as education outcomes may reflect purposeful choices and thus unobserved or unmeasured country characteristics. To address this concern, we consider another source of variation in military rivalry, namely the rivalries between the neighbors of each country. We first show reduced-form regressions of educational enrollment on this new rivalry

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[13] "Power" depends on a series of characteristics, from economic development to internal political stability, that we cannot control for in OLS regressions and is therefore a likely source of omitted-variable bias.

variable. We then take the bolder step of using it as an instrument for our previous rivalry measure.

Neighboring Rivalry as an Instrument   We construct a dummy variable for each country, using information on the rivalries of all its neighboring countries with third countries. More precisely, for country i, *Neighboring rivalry$_{i,t}$* is equal to 1 if in year t one of its bordering countries j is engaged in a rivalry with at least one other country k which is not contiguous to i. Importantly, we only take into account neighboring countries j and their respective rivals k that *do not* have a rivalry with country i. Hence, *Neighboring rivalry$_{i,t}$* measures rivalries in the regional environment of country i, between countries that have no rivalries in common with i. This measure of rivalry is much less of a choice variable for country i than the rivalry measure used in the OLS regressions, which mitigates the endogeneity problem. In the data, *Neighboring rivalry$_{i,t}$* is indeed a good predictor of the original rivalry variable, suggesting that when its regional environment (exogenously) becomes more unstable, country i as well is more likely to be engaged in a rivalry.

When it comes to sample selection, we construct the neighboring rivalry variable for the entire sample, except for countries in Western Europe and the Eastern Bloc during the Cold War.[14] We exclude these regions *a priori* because they were dominated by a series of strategic alliances driven by the United States and the USSR. Therefore, it is implausible to treat regional rivalries as exogenous. Moreover, regional rivalries have limited predictive powers on individual rivalries. When running the baseline specification on this smaller sample, we find results similar to Table 2, so any differences in results we find are not driven by changes in the sample.

Reduced-form Regressions   Panel A of Table 5 reports the results from reduced-form regressions. They have the same specification as our baseline regressions in Table 2, except that we replace *Rivalry* with *Neighboring rivalry* and the interaction between *Rivalry* and *Democracy* by the interaction between *Neighboring rivalry* and *Democracy*. The results are qualitatively similar to the baseline results. In particular, comparing the results in column 2 with those in column 2 of Table 2, the three central coefficients all

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[14]Specifically, we exclude the years from 1950 to 1990. The results are robust to small changes in these bounds.

maintain their signs and continue to be significant at the 1% level. The point estimate is higher for the rivalry variable, but similar for the democracy and interaction variables.

Table 5, Panel A, about here

IV Specification In a more demanding specification, we use *Neighboring rivalry* to instrument for *Rivalry.* The crucial assumption behind the IV regression is that, conditional on the set of controls, a neighboring rivalry does not directly affect primary enrollment in country i, beyond its indirect effect through country i's own rivalries.

There are several reasons to be concerned with this exclusion restriction. If country i is weak, countries j and k may more likely engage in rivalries, because i will not react – but if i is strong, countries j and k may decide to avoid rivalries because they suspect i would react to stabilize the region. Such behavior would bias our IV estimates downward – i.e., we would underestimate the effect of military threats on schooling. As we shall see, however, our IV estimates are larger than their OLS counterparts, suggesting that rivalries do indeed have a positive and significant effect on primary enrollment.

Another concern about the exclusion restriction might be an "entanglement effect". If neighbor j of country i is engaged in rivalries with other countries, country i might be less concerned about war because its neighbor is entangled in potential future wars with other countries. The first-stage regressions suggest that *Neighboring rivalry* does not capture such an effect since the instrument is positively correlated with *Rivalry.*

One may also be concerned that neighbor rivalries proxy for neighbor nationalism, which may be correlated with domestic nationalism. Furthermore, one may worry that neighboring rivalries affect trade patterns and, that way, domestic income, which could affect primary enrollment. While the exclusion restriction is not perfect, we cannot think of a better identification strategy to provide additional evidence that rivalries do have a causal effect on education.[15]

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[15]As a robustness check, we define a modified instrument: *Contiguous rivalry*$_{i,t}$ as the number of rivalries between bordering countries j and other countries k, weighted by the inverse of the distance between the capitals of countries i and j in year t. As before, we only take into account neighboring countries j and their respective rivals k that do not have a rivalry with country i. This approach yields estimates similar in magnitude to those obtained with *Neighboring rivalry.*

To run the IV, we also need an instrument for the interaction term between military threats and democracy. As in the reduced-form regressions, we use the interaction of *Neighboring rivalry* with *Democracy*. As before, we treat *Democracy* as exogenous. The results are qualitatively similar when we use lagged *Democracy* instead of *Democracy*.

The standard errors in all our IV regressions are heteroskedasticity-robust. We also report various other IV test statistics (*F*-test for excluded instruments, Anderson-Rubin test, Cragg-Donald Wald statistic, and Kleibergen-Paap Wald *rk F*-statistic[16]).

IV Results We run IV (2SLS) regressions with either one instrument and one endogenous regressor (*Rivalry*) or with two instruments and two endogenous regressors (*Rivalry* and *Rivalry·Democracy*). The results are reported in the remaining panels of Table 5. Panel B shows that the first-stage estimates have the expected signs and that the instruments are not weak. Panel C reports the second-stage estimates: the point estimate on *Rivalry* is larger than in the OLS regressions[17] and the interaction between *Rivalry* and *Democracy* is positive and statistically significant, with roughly the same magnitude as in the OLS regressions. Panel C presents additional test statistics, which reject weak identification. However, if we do include Western Europe and the Eastern Bloc during the Cold War in the sample, the instruments do indeed become weak.[18]

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Table 5, Panels B and C, about here

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Overall, the reduced-form results and the IV results suggest that military threats do indeed have a strong positive effect on primary enrollment.

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[16]Stock and Yogo (2005) derive the critical values for the Cragg-Donald Wald statistic, which is valid under homoskedasticity. The rule of thumb is to use the same critical values for the Kleibergen-Paap Wald rk F statistic, which is valid under heteroskedasticity. We are not aware of similar tests that are valid under clustering. With one instrument, the Stock-Yogo weak ID test critical values at different maximal IV sizes are as follows: 10%: 16.38, 15%: 8.96, 20%: 6.66, With two instruments, they become: 10% : 7.03, 15%: 4.58, 20%: 3.95.

[17]A likely explanation for why the IV estimates are bigger than the OLS estimates is classical measurement error of the rivalry measure. Another explanation is heterogeneity in the treatment effect, since the IV coefficient yields an estimate of LATE, which may be larger than ATE.

[18]These regressions are reported in the Online Appendix – see Table W1. See Stock and Yogo (2005) on weak instruments and biased IV estimators.

4.6   Summary of Empirical Findings

Taken together, our empirical results provide robust evidence that in the wake of increased strategic rivalry (or in reaction to past wars), countries invest more in mass education. Everything else equal, democracies invest less in primary education than do autocracies. But the interaction between democracy indicators and military rivalry appears to be positive, especially when democracy is measured by constraints on the executive.

5   A Simple Theory

In this section, we lay out a formal model in which public education plays a key role in the efficient operation of the military. The model is constructed so as to be consistent with our main three empirical findings and thus helps us interpret them. In addition, the model has an auxiliary prediction, which we also confront with data.

Basic Setup   The formal model we develop borrows in spirit from the state-capacity frameworks of Besley and Persson (2009, 2011), from the voter-participation models by Feddersen and Sandroni (2002) and Coate and Conlin (2004), and from the model in Ticchi and Vindigni (2009) of fighting incentives across different political regimes.

Consider a society, where population is normalized to unity and divided into two equally large and homogenous groups (with regard to education) of risk-neutral individuals, $J = I, O$. There are two time periods. Output per capita in each period – equal to total resources and the tax base – is exogenous, constant over time, normalized to $\frac{1}{2}y(e)$, and non-decreasing in the level of public education e with $y(e) = 1 + \beta e$.

All consumption takes place at the end of the second period. One of the groups serves as the incumbent in both periods (thus there is no political turnover). Among specific political institutions, we focus on the constraints on the executive, as the empirical findings in Section 4.4 favor this aspect of democracy. Such constraints are modeled as a share of output δ that the incumbent group, I, must grant to the opposition group, O – thus, a higher value of δ captures stronger executive constraints (protecting the opposition group from discretionary redistribution).

A war can occur in period 2 with exogenous probability p. For simplicity,

if a war is lost all (accumulated) income perishes from the country as a whole – i.e., from both groups.

Education and the Probability of Winning   The probability q of winning a war, once it has broken out, depends on individual effort choices by the members of each group in period 2. Specifically, each individual can expend a unit of effort at a (utility) cost, which is decreasing in the level of education e. We assume a very simple cost function $\frac{x}{e}$, where x is individual-specific and uniformly distributed on $[0, 1]$ in each group.[19] Any individual in group J follows a behavioral rule to expend his unit of effort if $\frac{x}{e} < \frac{\omega_J}{e}$. Here, ω_J is a rule set by group J members that – if followed by all other members of the group – maximizes the group's aggregate utility. In Feddersen and Sandroni's language, each individual member of group J wants to "do her part" to maximize the group's utility.

The conditional probability of winning the war depends on the shares of individuals in each group that expend effort as:

$$q = \frac{1}{\alpha} \left[\left(\int_0^{\omega_O} dx \right)^\alpha + \left(\int_0^{\omega_I} dx \right)^\alpha \right] = \frac{1}{\alpha} (\omega_O^\alpha + \omega_I^\alpha) \ ,$$

where we assume that $\alpha < 1$. This formulation assumes that (aggregate) efforts of the two groups are complements. This could be for geographical reasons: if the two groups inhabit different parts of the country's territory, effort is needed along different parts of the border. Alternatively, the two groups might represent a dominant elite from which officers are drawn and the masses from which common soldiers are drawn: again, effort is needed from both groups. We see this assumption as reflecting an important distinguishing feature of the technology of modern wars – say after after 1820 – compared to those in earlier periods.

The level of public education is chosen by the incumbent group in period 1. It can augment the initial education level, normalized at zero, by invest-

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[19]We abstract from the possibility that higher primary education might also give better outside options to people who previously had no education, which in turn would tend to increase – not decrease – military costs. However, this is not a major concern to understand empirical patterns during the period that we study, since the overwhelming majority of countries in our sample enforced military conscription. Useful references on this topic include the CIA World Factbook (https://www.cia.gov/library/publications/the-world-factbook/) and the Office of the United Nations High Commissioner for Human Rights (http://www.nationmaster.com/graph/mil_con-military-conscription)

ment e in education at convex cost $C(e) = e^\gamma$, where $\gamma > 1$. We study this choice of education below.

Timing   The timing of the model is as follows

1. In period 1, the incumbent makes investment e in future education

2. At the beginning of period 2, a war with a foreign power erupts with probability p.

3. If war has erupted, members of each group choose the behavioral rule for effort choice, thus setting ω_I and ω_O. Individual members of each group observe the individual component of their effort cost x and then choose whether to expend one unit of effort at cost $\frac{x}{e}$.

4. An ongoing war is won with probability q.

5. If no war has erupted or a war has been won, the incumbent group consumes a share $1 - \delta$ of output $y(e)$, while the opposition group consumes $\delta y(e)$. After a lost war, the consumption of both groups is zero.

To analyze the model, we proceed by backward induction, starting from the effort choices at stage 3 and going back to the education choice at stage 1. For simplicity, we assume no time discounting.

Equilibrium Efforts   Without a behavioral rule for effort choice, individuals would face a severe free-rider problem similar to the problem of voter participation. In our setting, individuals choose to expend effort when their utility cost is low enough. In analogy with the analyses in Feddersen and Sandroni (2002) and Coate and Conlin (2004), we assume that group members choose the behavioral rule that maximizes the expected payoff to the group: i.e., expected consumption minus the group-wide cost of effort.

Thus, members of group O solve

$$\max_{\omega_J} \left\{ q\delta y(e) - \left(\int_0^{\omega_O} \frac{x}{e} dx \right) \right\} = \left\{ \frac{1}{\alpha}(\omega_O^\alpha + \omega_I^\alpha)\delta y(e) - \frac{1}{e}\frac{\omega_O^2}{2} \right\} ,$$

taking ω_I as given. Analogously, the effort by members of the incumbent group solves

$$\max_{\omega_I} \left\{ \frac{1}{\alpha}(\omega_O^\alpha + \omega_I^\alpha)(1-\delta)y(e) - \frac{1}{e}\frac{\omega_I^2}{2} \right\} .$$

Simple algebra gives:

$$\omega_O = (\delta y(e)e)^{\frac{1}{2-\alpha}} \quad \text{and} \quad \omega_I = ((1-\delta)y(e)e)^{\frac{1}{2-\alpha}} .$$

In equilibrium, the conditional probability of winning a war q becomes[20]:

$$q^*(e,\delta) = \frac{1}{\alpha}[ey(e)]^{\frac{\alpha}{2-\alpha}} \left[\delta^{\frac{\alpha}{2-\alpha}} + (1-\delta)^{\frac{\alpha}{2-\alpha}} \right] . \tag{2}$$

Equilibrium Education Moving back to period 1, the incumbent group chooses education investment e to

$$\max_e [(1-p) + pq^*(e,\delta)][(1-\delta)y(e) - C(e)] ,$$

where the term in the first bracket is the probability that the war is not lost, and the second bracket is the incumbent's share of output less the cost of investment. The corresponding first-order condition is:

$$C'(e) = \gamma e^{\gamma-1} = (1-p)(1-\delta)y'(e) + p(1-\delta)\frac{\partial[q^*(e,\delta)y(e)]}{\partial e} ,$$

where $y'(e) = \beta \geq 0$. Using this and (2), we obtain

$$
\begin{aligned}
\gamma e^{\gamma-1} = {} & (1-p)(1-\delta)\beta \\
& + \frac{p(1-\delta)}{\alpha} \left[\delta^{\frac{\alpha}{2-\alpha}} + (1-\delta)^{\frac{\alpha}{2-\alpha}} \right] \frac{\partial}{\partial e}[e^{\frac{1}{2-\alpha}}y(e)^{\frac{3-\alpha}{2-\alpha}}].
\end{aligned}
\tag{3}
$$

This equation determines the equilibrium level of education e as a function of parameters (δ, β, p). For γ sufficiently large, equilibrium e is sufficiently small that $q^*(e,\delta)$ lies strictly between 0 and 1, as claimed earlier.

---

[20]Note that we are implicitly assuming an interior solution $q^* \in (0,1)$. This in turn is guaranteed by assuming γ sufficiently large, which in turn implies that the equilibrium e is sufficiently small.

Comparative Statics Performing comparative statics on (3) gives us:

Prediction 1 *For δ sufficiently small, $\alpha < 1$, γ large enough (to avoid corners), and $\beta > 0$, equilibrium investment in education e is:*
1. *increasing in the risk of war, p*
2. *positively affected by the interaction between democracy δ and the risk of war p*
3. *decreasing in democracy for $p = 0$ or small.*
Thus, $\frac{\partial e}{\partial p} > 0$, $\frac{\partial^2 e}{\partial p \partial \delta} > 0$, and $\frac{\partial e}{\partial \delta}_{|p=0} < 0$.

Proof. Part 1 follows straightforwardly from the fact that

$$\frac{(1-\delta)}{\alpha} \left[\delta^{\frac{\alpha}{2-\alpha}} + (1-\delta)^{\frac{\alpha}{2-\alpha}} \right] \frac{\partial}{\partial e} [e^{\frac{1}{2-\alpha}} y(e)^{\frac{3-\alpha}{2-\alpha}}]$$
$$> \quad > (1-\delta)\beta$$

when δ is sufficiently small and $\alpha < 1$.

Part 2 follows from (3) and from the fact that $\frac{\partial}{\partial e}[e^{\frac{1}{2-\alpha}} y(e)^{\frac{3-\alpha}{2-\alpha}}] > 0$ and that:

$$\text{sign}\left(\frac{\partial^2 e}{\partial p \partial \delta} \right) = \text{sign}\left(\frac{\partial}{\partial \delta}\{(1-\delta)E(\delta)\} \right) ,$$

where

$$E(\delta) \equiv \left[\delta^{\frac{\alpha}{2-\alpha}} + (1-\delta)^{\frac{\alpha}{2-\alpha}} \right] .$$

But one can verify that

$$\frac{\partial}{\partial \delta}\{(1-\delta)E(\delta)\} = -E(\delta) + (1-\delta)\left(\frac{\alpha}{2-\alpha} \right)\left(\delta^{\frac{\alpha}{2-\alpha}-1} - (1-\delta)^{\frac{\alpha}{2-\alpha}-1} \right) ,$$

where the first term on the right-hand side remains bounded when $\delta \to 0$ whereas the second term becomes arbitrarily large provided $\alpha < 1$.

Finally, Part 3 follows from the fact that the right-hand side of (3) is unambiguously decreasing in δ for $p = 0$ and for $\beta > 0$. ∎

Consistency with the Empirical Findings Parts 1-3 of Prediction 1 are obviously consistent with the three main findings reported in Section 4. Intuitively, democracy has a direct negative effect on the motives to invest

in education, because stronger constraints on the executive reduce the incumbent's residual claim on the additional output generated by education.[21] For the effect of war threat and the positive interaction between war threat and democracy, the intuition goes as follows. Society's income is (partly) expropriated if a war is lost to a foreign power. The probability of winning a war depends upon both the educational level and fighting efforts by members of the incumbent and opposition groups. In these circumstances, the incumbent group has stronger motives to invest in education if a war becomes more likely. Absent some executive constraints, however, opposition-group members do not benefit a great deal from the economy's resources. Therefore, they have weaker incentives to exert fighting effort than members of the incumbent group – this mechanism is similar to the one in Ticchi and Vindigni (2009). If the efforts by the incumbent and opponent groups are sufficiently complementary ($\alpha < 1$), this incentive gap may lower the prospects of winning a war to such an extent that investments in education respond less to a higher war threat in autocracies than in democracies.[22]

An Auxiliary Prediction   The unverifiable and complementary effort decisions by members of the two groups drive the model's positive interaction effect between military threats and democracy. In the case of physical investments, their contribution to military success presumably depend less on such unverifiable efforts. By this logic, we can state an auxiliary prediction:

Prediction 2 *Military rivalry might affect other measures of state capacity such as infrastructure, but then the interaction between rivalry and democracy should be weak or insignificant.*

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[21] A potentially counteracting effect, pointed out to us by a referee, is that more democracy should constrain the incumbent to align herself more with the median voter's incentives to invest in education. This in turn might result in more educational investment. We are ignoring this effect by assuming that educational investment is decided by an incumbent in period 1, no matter the constraint on the executive at that date. In our model, which stresses constraints on the executive, democracy thus affects surplus sharing but not who decides about education. However, our regressions suggest that, if anything, such counteracting effect of democracy would be dominated. Moreover, we think that our model captures the reality of most representative democracies where, once elected, politicians still enjoy a large degree of discretion over public investment policy.

[22] Note again that the conclusions change dramatically if $\alpha = 1$. Thus our conclusions rely on the pivotal assumption that war efforts from the opposition group are indispensable: this captures war technology in the 19th century as opposed to the medieval period.

Testing Prediction 2 We confront Prediction 2 with data on the length of paved roads from Calderón and Servén (2010), which covers 97 countries over the period 1960-2000. Table 6 shows the results of estimating our main baseline specification with the yearly percentage change in the length of paved roads as the dependent variable. While military rivalries still drive this type of investment, the political regime has no effect – neither directly nor through the interaction term – on road-building.

Table 6 about here

6 Conclusion

We have argued that military rivalry is an important factor behind countries' decisions to invest in mass primary education. If anything, democratization seems to have a negative direct effect on such investments, although primary enrollment appears to respond more to military threats in democracies than in autocracies.

Our approach could profitably be extended in several directions. One would be to look at the effect of military rivalry on other types of public investments, not just primary education (and road expenditure). Some preliminary regressions using Barro-Lee data on secondary-school enrollment suggest a positive correlation between this variable and military rivalry, at least when restricting attention to countries with high per-capita GDP. One could also look at how much current or past military rivalry affects future fiscal capacity following the lead of Tilly (1975) and, more recently, Besley and Persson (2009).

A second extension would be to investigate if other forms of rivalry – for example cross-country competition in product markets, or the importance of international benchmarking, e.g., as induced by cross-country performance in PISA or Shanghai evaluations – have a similar effect as military rivalry on educational enrollment and other types of public investments.

A third extension could be to look at different types of conflicts. One could look more closely at the correlation between enrollment and past wars, in particular distinguishing between won and lost wars. Preliminary regressions show a positive correlation between primary enrollment and both a lost war and a won war over the past 10 years, with a stronger correlation if the war was won. This finding contradicts the view that past wars favor future

education investments because defeats weaken incumbent elites that might oppose mass education, but could reflect a scarcity of public funds if states' financial resources are more depleted after defeats than after victories.

A fourth extension would be to consider not only primary enrollments, but also the governance of primary (and secondary) schools. Recent work by Algan, Cahuc and Shleifer (2013) distinguishes vertical and horizontal school pedagogy, where the former relies on taking notes from the teacher, whereas the latter relies on group interactions among students. One conjecture is that primary-education reforms with their roots in military rivalry are more likely associated with vertical systems. Investigating these and other extensions is left for future research.

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A   Data Appendix: Strategic Rivalries

Thompson (2001) lists the following qualitative coding rules to define strategic rivalries and their duration for the period 1816-1999:

1. "Strategic rivals must be independent states, as determined by Gleditsch and Ward's (1999) inventory of independent states.

2. Beginning and ending dates are keyed as much as possible to the timing of evidence about the onset of explicit threat, competitor, and enemy perceptions on the part of decision-makers. Historical analyses, for instance, often specify that decision-makers were unconcerned about a competitor prior to some year just as they also provide reasonably specific information about the timing of rapprochements and whether they were meaningful ones or simply tactical maneuvers. (...)

   As a general rule, the competitor criterion restricts rivalries to their own class within the major-minor power distinction. Major (minor) power rivalries are most likely to involve two major (minor) powers. Definitely, there are exceptions to this rule. Major-minor power rivalries emerge when minor powers become something more than nuisances in the eyes of major power decision-makers. Capability asymmetry may still be quite pronounced but that does not mean that the major power is in a position to, or is inclined toward, the use of its capability advantage. (...)

3. No minimal duration is stipulated in advance (...)

4. Various constituencies within states may have different views about who their state's main rivals are or should be. Unless they control the government, constituency views are not considered the same as those of the principal decisionmakers. If the principal decision-makers disagree about the identity of rivals, the operational problem then becomes one of assessing where foreign policy-making is most concentrated. (...)

5. If two states were not considered rivals prior to the outbreak of war, they do not become rivals during the war unless their rivalry extends beyond the period of war combat. This rule is designed to avoid complications in assessing the linkages between rivalry and intensive forms of conflict. (...)

6. One needs to be especially skeptical about dating rivalry terminations. Some rivalries experience short-lived and highly publicized rapprochements that turn out to be less meaningful than one might have thought from reading the relevant press accounts at the time. Some rivalries enter long periods of hibernation only to erupt suddenly as if nothing had changed. All of these situations may share the outward appearance of rivalry termination. What needs to be manifested is evidence of some explicit kind of a significant de-escalation in threat perceptions and hostility. (...)

7. The most valuable sources for information pertinent to identifying strategic rivalry are political histories of individual state's foreign policy activities."

Colaresi et al. (2010) further refine the data to distinguish between three types of rivalries: spatial, where rivals contest the exclusive control of a territory; positional, where rivals contest relative shares of influence over activities and prestige within a system or subsystem; and ideological, where rivalscontest the relative virtues of diffrent belief systems relating to political, economic or religious activities.

B Tables

Table 1: Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Primary enrollment per 10,000	7125	1048.971	534.812	1	3168
Rivalry	4995	0.713	0.453	0	1
War in past 10 years	7258	0.147	0.354	0	1
At war	6738	0.047	0.211	0	1
Democracy	7222	-0.377	7.111	-10	10
Openness of executive	6973	3.235	1.388	0	4
Constraints on executive	6973	3.906	2.385	1	7
Population growth (10 yrs)	4972	19.381	15.216	-60.424	207.327
Military expenditure (p.c.) (1)	7258	0.114	0.350	0	5.314
Military expenditure (p.c.) (2)	7258	41.652	203.051	0	7398.568
Military expenditure / GDP	4245	4.232	5.864	0	140.782
Military exp. / Government exp.	4895	22.744	24.147	0	409.671
Urbanization (100,000)	7219	14.278	13.779	0	100
Urbanization (50,000)	6559	18.040	16.474	0	384.7
Urbanization (20,000)	6314	24.852	18.500	0	122.6
Industry share of GDP	3880	26.657	14.213	0	85
Ethnic fractionalization	6907	39.741	25.306	0	93.017

Note: Unbalanced panel of 137 countries over the period 1830-2001. Military expenditure per capita (1) before 1914 in British pounds, set to zero after 1914; (2) after 1914 in US dollars, set to zero before 1914.

Table 2: Primary Enrollment and War Risk

	Primary enrollment per 10,000					
	Strategic Rivalry			War in previous 10 years		
	(1)	(2)	(3)	(4)	(5)	(6)
Rivalry	160.321***	180.098***	101.704***			
	(21.755)	(23.313)	(24.567)			
Democracy	-2.876*	-13.076***	-7.776***	-7.523***	-7.861***	-4.881***
	(1.477)	(2.284)	(2.484)	(1.300)	(1.336)	(1.463)
Rivalry*Democracy		15.616***	1.961			
		(2.500)	(2.407)			
Rel. army of rivals			2.083**			
			(0.950)			
War in				75.808***	73.778***	98.977***
previous 10 years				(16.900)	(17.328)	(16.145)
War in 10 years					2.313	-3.295*
*Democracy					(2.024)	(1.814)
War casualties						0.204*
						(0.114)
Urbanization	12.446***	11.902***	10.923***	16.554***	16.628***	11.672***
	(1.322)	(1.279)	(1.480)	(1.102)	(1.107)	(1.045)
Population growth	8.160***	8.118***	4.604***	6.775***	6.789***	4.768***
	(1.143)	(1.116)	(0.921)	(0.808)	(0.802)	(0.719)
Military expenditure p.c.	189.300***	178.482***	209.813***	218.766***	218.344***	225.617***
before 1914	(66.703)	(64.325)	(65.444)	(63.822)	(63.671)	(44.397)
Military expenditure p.c.	-0.739***	-0.726***	-0.317***	-0.891***	-0.886***	-0.389***
after 1914	(0.126)	(0.125)	(0.093)	(0.129)	(0.129)	(0.080)
Govt expenditure / GDP			-0.116			0.416
			(0.392)			(0.352)
Observations	3140	3140	1830	4364	4364	2948
R-squared	0.762	0.767	0.856	0.738	0.738	0.824

Notes: All specifications include country and time fixed effects. Robust standard errors in brackets. ***p<0.01, ** p<0.05, * p<0.1. In columns (1) to (3) war risk is measured by the existence of one or more strategic rivalries according to the Thompson (2001) classification. In columns (4) to (6) war risk is measured by the occurrence of a war involving the country in the previous 10 years.

Table 3: Education and Probability of Victory

| | Probability of war in next 10 years | | Probability of winning if war in next 10 years | | Military expenditure | |
| | | | | | / GDP | / Gov't exp. |
	(1)	(2)	(3)	(4)	(5)	(6)
Primary enrollment per 100	0.011***	0.014***	0.044***	0.046***		
	(0.002)	(0.002)	(0.006)	(0.007)		
Democracy	-0.002	0.001	-0.015***	-0.017***	-0.168***	-0.179
	(0.001)	(0.001)	(0.004)	(0.004)	(0.036)	(0.161)
Rivalry	0.146***	0.177***		0.012	0.573*	8.021***
	(0.015)	(0.020)		(0.056)	(0.317)	(1.654)
Rivalry*Democracy					0.115***	0.297*
					(0.038)	(0.173)
Urbanization		-0.001	-0.006*	-0.006	0.014	-0.129*
		(0.001)	(0.003)	(0.004)	(0.019)	(0.076)
Population growth		-0.001**			0.053***	0.011
		(0.001)			(0.019)	(0.043)
Military expenditure p.c.		-0.053**	-0.492***	-0.502***		
before 1914		(0.026)	(0.090)	(0.091)		
Military expenditure p.c.		0.000	-0.001***	-0.001**		
after 1914		(0.000)	(0.000)	(0.000)		
Military size / Population				-3.702		
				(3.005)		
At war					1.470**	6.885
					(0.577)	(4.260)
Observations	4489	3140	817	715$\frac{rests}{}$	2028	2321
R-squared	0.353	0.391	0.813	0.804	0.599	0.452

Notes: All specifications include country and time fixed effects. Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. In columns (1) and (2), the dependent variable is the probability of observing a war involving the country in the next 10 years. In columns (3) and (4), the sample includes only countries which experience a war outbreak in the next 10 years, and the dependent variable is the probability of winning this future war. Primary enrollment is defined per 100 inhabitants (instead of per 10,000 inhabitants) for this table only. In columns (5) and (6), the dependent variable is military expenditure respectively as a share of GDP and as a share of total government expenditure..

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Table 4: Components of Democracy

	Primary enrollment rate					
	(1)	(2)	(3)	(4)	(5)	(6)
Rivalry	145.728***	205.438***	165.214***	108.479***	140.131***	183.359***
	(21.904)	(37.383)	(21.386)	(22.227)	(21.634)	(38.172)
Executive constraints			87.237***	-23.216	126.861***	3.555
			(16.564)	(34.460)	(17.111)	(33.172)
Executive constraints*Rivalry				142.098***		168.506***
				(36.851)		(34.870)
Executive openness	-82.047***	-26.524			-121.455***	-20.229
	(18.112)	(34.175)			(18.042)	(32.994)
Executive openness*Rivalry		-78.943**				-146.360***
		(38.054)				(37.742)
Urbanization	12.369***	12.627***	11.453***	11.224***	11.366***	11.510***
	(1.297)	(1.290)	(1.340)	(1.309)	(1.310)	(1.258)
Population growth	7.869***	7.825***	7.862***	7.896***	7.582***	7.524***
	(1.127)	(1.130)	(1.098)	(1.081)	(1.112)	(1.095)
Military expenditure p.c. before 1914	186.510***	186.028***	184.584***	180.076***	177.710***	170.962***
	(65.551)	(65.432)	(66.858)	(66.352)	(64.623)	(63.727)
Military expenditure p.c. after 1914	-0.740***	-0.748***	-0.718***	-0.707***	-0.716***	-0.715***
	(0.126)	(0.127)	(0.126)	(0.124)	(0.125)	(0.125)
Observations	3145	3145	3145	3145	3145	3145
R-squared	0.764	0.765	0.765	0.766	0.769	0.772

Notes: All specifications include country and time fixed effects. Robust standard errors in brackets. ***p<0.01, ** p<0.05, * p<0.1. "Executive constraints" is equal to 1 if xconst is greater than or equal to 4 in the Polity IV database, and 0 otherwise. "Executive openness" is equal to 1 if xropen is greater than or equal to 3 in the Polity IV database, and 0 otherwise.

Table 5: Rivalries in Neighboring Countries
Panel A: Reduced-form Regressions

| | Primary enrollment rate | |
	(1)	(2)
Neighboring rivalry	283.702***	251.776***
	(17.688)	(19.419)
Democracy	-7.560***	-17.659***
	(1.226)	(2.088)
Neighboring rivalry*Democracy		14.239***
		(2.210)
Urbanization	15.857***	15.250***
	(1.101)	(1.091)
Population growth	6.230***	6.115***
	(0.793)	(0.758)
Military expenditure p.c.	210.618***	211.708***
before 1914	(61.586)	(61.698)
Military expenditure p.c.	-0.837***	-0.807***
before 1914	(0.133)	(0.130)
Observations	4237	4237
R-squared	0.749	0.753

Notes: All specifications include country and time fixed effects. Robust standard errors in brackets. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 5: Rivalries in Neighboring Countries
Panel B: First-Stage Regressions

1st Stage	(1) Rivalry	(2) Rivalry	(3) Rivalry*Democracy
Neighboring rivalry	0.234***	0.235***	-1.661***
	(0.035)	(0.036)	(0.287)
Neighboring rivalry*Democracy		-0.001	0.361***
		(0.004)	(0.033)
Democracy	-0.003**	-0.002	0.401***
	(0.001)	(0.004)	(0.033)
Urbanization	-0.007***	-0.007***	-0.025**
	(0.001)	(0.001)	(0.010)
Population growth	0.002***	0.002**	0.005
	(0.000)	(0.000)	(0.004)
Military expenditure (p.c)	-0.029**	-0.029**	0.236**
before 1914	(0.012)	(0.012)	(0.106)
Military expenditure (p.c)	0.000**	0.000**	-0.000**
after 1914	(0.000)	(0.000)	(0.000)
Excluded Instruments	Neighboring rivalry	Neighboring rivalry	Neighboring rivalry
		Neigh. rivalry*Democracy	Neigh. rivalry*Democracy
F-statistic of Excluded Instruments	45.90	24.38	65.72
Observations	2725	2725	2725
R-squared	0.943	0.943	0.901

Notes: All specifications include country and time fixed effects. Robust standard errors in brackets. ***
p<0.01, ** p<0.05, * p<0.1. For country i, *Neighboring rivalry*$_{i,t}$ is equal to 1 if in year t one of its
bordering countries j is engaged in a rivalry with at least one other country k which is not contiguous to
i. The sample excludes Western Europe and the Eastern bloc during the Cold War.

Table 5: Rivalries in Neighboring Countries
Panel C: Second Stage Regressions

	Primary enrollment rate	
2nd Stage		
Rivalry	478.656***	684.394***
	(117.082)	(138.879)
Rivalry*Democracy		42.166***
		(8.157)
Democracy	1.090	-28.863***
	(1.423)	(6.013)
Urbanization	8.210***	11.277***
	(1.828)	(2.025)
Population growth	5.397***	4.887***
	(0.901)	(0.878)
Military expenditure (p.c.)	115.036***	114.003***
before 1914	(41.694)	(40.967))
Military expenditure (p.c.)	-0.557***	-0.563***
after 1914	(0.123)	(0.123)
Endogenous Regressors	Rivalry	
		Rivalry*Democracy
Instruments	Neighboring rivalry	Neighboring rivalry
		Neighboring rivalry*Democracy
Anderson-Rubin Wald test	17.77	
Cragg-Donald Wald F statistic	92.78	
Kleibergen-Paap Wald rk F statistic	45.90	
Observations	2725	2725
R-squared	0.824	0.811

Notes: All specifications include country and time fixed effects. Robust standard errors in brackets. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. The sample excludes Western Europe and the Eastern bloc during the Cold War.

Table 6: Road Investments, Rivalry and Democracy

| | % change in length of paved roads | | | |
	(1)	(2)	(3)	(4)
Rivalry	2.400**	2.503**	2.477***	2.522***
	(0.968)	(0.989)	(0.948)	(0.932)
Democracy		0.048	0.063	0.040
		(0.052)	(0.101)	(0.103)
Rivalry*Democracy			-0.023	-0.008
			(0.110)	(0.110)
Urbanization	-0.161***	-0.169***	-0.168***	-0.194***
	(0.053)	(0.054)	(0.054)	(0.055)
Military expenditure (p.c.)	0.003	0.003*	0.003*	0.004***
	(0.002)	(0.002)	(0.002)	(0.002)
Real GDP				1.376*
				(0.826)
Road length per square km				-0.004***
				(0.001)
Observations	2566	2542	2542	2542
R-squared	0.122	0.125	0.125	0.127

Notes: All specifications include country and time fixed effects. Robust standard errors in brackets.
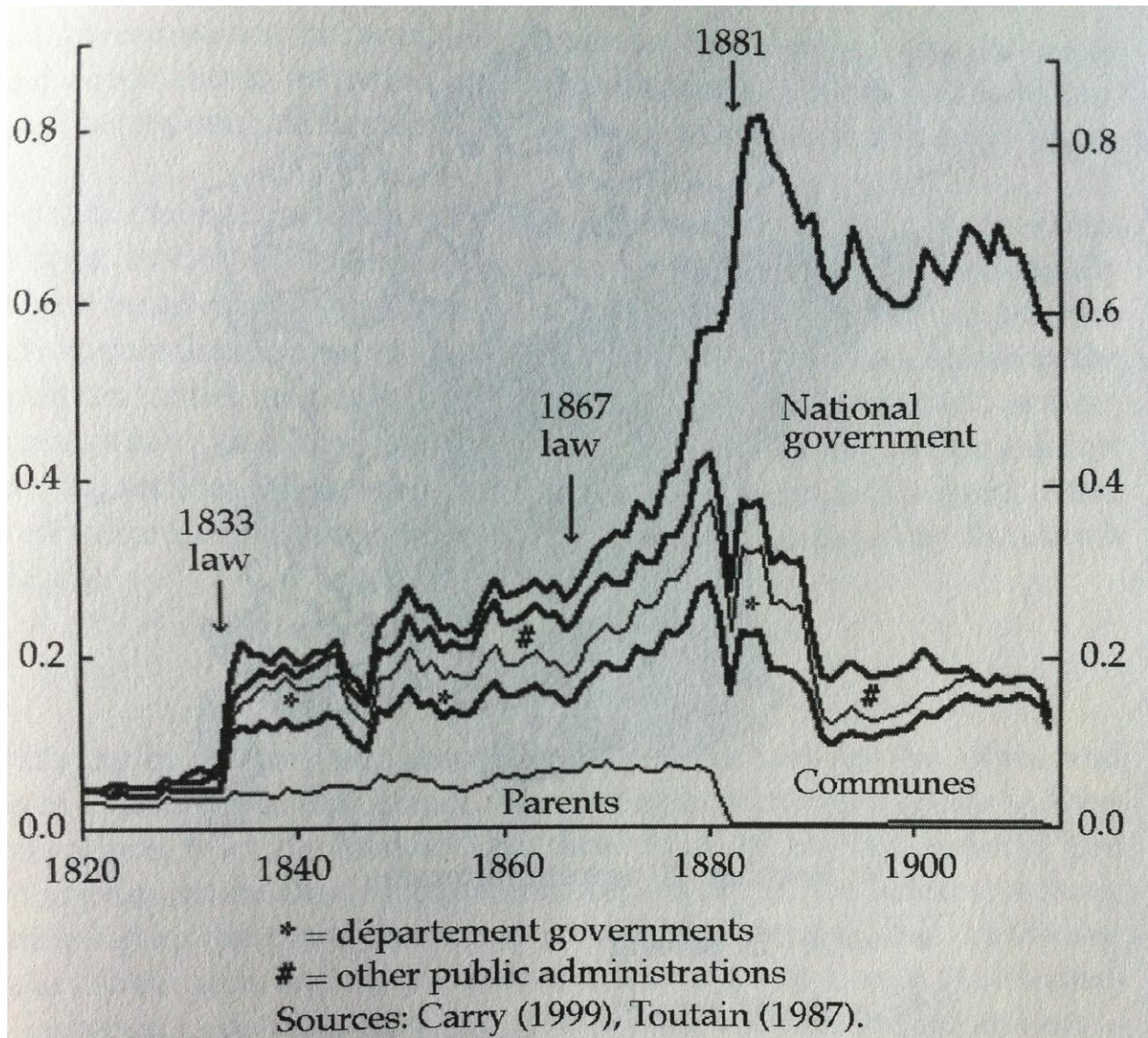*** p<0.01, ** p<0.05, * p<0.1

0.8

0.6

0.4

0.2

0.0

1881

1867
law

1833
law

National
government

Parents

Communes

1820   1840   1860   1880   1900

* = département governments
\# = other public administrations
Sources: Carry (1999), Toutain (1987).

FIGURE 1