Education and Military Rivalry*

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Abstract

Using data from the last 150 years in a small set of countries, and from the postwar period in a large set of countries, we show that large investments in state primary education systems tend to occur when countries face military rivals or threats from their neighbors. By contrast, we find that democratic transitions are negatively associated with education investments, while the presence of democratic political institutions magnifies the positive effect of military rivalries. These empirical results are robust to a number of statistical concerns and continue to hold when we instrument military rivalries with commodity prices or rivalries in a certain country's immediate neighborhood. We also present historical case studies, as well as a simple model, that are consistent with the econometric eveidence.

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1 Introduction

What makes countries engage in mass education investments? A common view is that such investments are the flipside of democratic transitions (see e.g., Bourguignon and Verdier, 2000). Absent democracy, the elite chooses to deny mass access to education in order to secure its power, while the introduction of democracy – extending the franchise, increasing electoral competition, or putting tighter constraints on the executive – promotes decisions that favor mass education. This explanation might look quite convincing, and seemingly accounts for the history of education enrollment in Europe starting with France. Indeed, Figure 1 (drawn from Lindert, 2004), suggests that public contributions to primary-school education went up sharply in 1880, once France had completed its transition from the Second Empire to the Third Republic, which clearly reflected a move towards greater democracy.[1]

Figure 1 about here

However, another event that precipitated the fall of the Second Empire is 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, 2004a, p. 112)

One reason why a military defeat may spur centralized investment in mass education is suggested in the work of Eugene Weber on the modernization of rural France between 1870 and 1914 (Weber, 1979). A highly disintegrated

[1] The complementary view that education favors democracy is analyzed, in particular, by Glaeser et al. (2007).

population, largely illiterate, speaking a multiplicity of dialects, and with no sense of nationhood[2], was to be transformed into a unified people sharing the same patriotic values, a spoken and written language, a set of moral principles, and a motivation and ability to defend France in future conflicts[3].

In this paper, we study historical panel data on education spending and enrollment – for Europe since the 19th century and a larger set of countries in the postwar period – to assess the correlation between military rivalry (or war risk) and primary education enrollment (or the occurrence of educational reforms). First, we perform standard OLS regressions and find that, conditional on country and year fixed effects, mass education is positively and significantly associated with military rivalry, or involvement in an external war in the previous 10 years. Moreover, while the coefficient on democracy (gauged by the Polity IV index) comes out negative when we control for military rivalry, the interaction between the two variables is often positively and significantly associated with mass education. The coefficient on military rivalry remains stable when we control for the political regime, suggesting that military threats have a stable and independent influence on mass education.

To deal with appropriate concerns about endogeneity, we then instrument military rivalry in two different ways. Our first instrument uses data on commodity prices. The idea is that high prices of natural resources or agricultural commodities likely foster rivalries, as states are tempted to compete for control of more valuable resources. Our second instrument uses rivalries with third countries of those countries with which a certain country shares a border. The idea here is to captures when military rivalries are rife in a country's neighborhood. The corresponding IV specifications show a positive and significant effect of rivalry on primary enrollment, a negative direct effect of democracy, and (for the second instrument) a positive and significant interaction term between the two. Overall, our empirical results indicate a causal relationship from rivalry to primary educational enrollment.

Our paper relates to, at least, three literatures. As for the relationship between public education investment 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, due to

[2] As a French novelist of that time would put it "In Velay, the word "patrie" signifies nothing and stirs nothing. It exists no more in local speech than in local hearts".

[3] 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".

the need for civic participation to raise support for transitions from dictatorship into democracy. But the evidence for a positive relationship between education spending or enrollment and democracy is mixed, at best. In particular, Mulligan, Gil, and Sala-i-Martin (2004) present cross-country evidence indicating that more democratic political institutions do not seem to be correlated with higher levels of social expenditures and, in particular, higher public education spending. More recently, Bursztyn (2011) shows that poor voters in Brazil might prefer the government to allocate resources to redistributive policies, yielding immediate income increases (such as cash transfers), instead of allocating resources to public primary education. Also related to our analysis is the work by Bourguignon and Verdier (2000), who develop a model to explain why the ruling class may sometimes decide to invest in education even though schooling enhances political participation. Along similar lines, Galor et al (2006) argue that capital accumulation gradually intensifies the importance of skilled labor in production and therefore generates support among the ruling class for investing more in human capital. Galor et al. (2008) argue that a higher concentration of land ownership typically discourages the development of human capital enhancing institutions, in particular schooling. However, none of these papers looks at the effect of military threats in democracies and autocracies.

A second related literature deals with the economic and political impact of wars. On the latter, Ticchi and Vindigni (2009) analyze theoretically a mechanism whereby international conflict may trigger democratic transitions, 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 literature on the economic impact of wars starts with Anderton and Carter (2001), Blomberg and Hess (2006), and Glick and Taylor (2005). More recent work by Martin, Mayer and Thoenig (2008a, b) and by Acemoglu and Yared (2009) evaluates the extent to which wars reduce trade flows. This research does not generally investigate the links between wars and investment in education, though.

A third related literature deals with fiscal capacity and state capacity more generally. Hintze (1975) and Tilly (1975), preceding many others, provide historical accounts on the importance of wars for state building. More recently, an economic literature summarized in Besley and Persson (2011) considers theoretically investments in fiscal and legal capacity, and finds robust correlations between past wars and current state capacity in international panel data. Thies (2004), using the same measure of strategic rivalry

as we do, shows that military rivalry raises 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 have a systematic influence on top rates of estate taxation, whereas wars with mass mobilizations do significantly raise these rates. Analogously, we find support for a correlation between past wars (and military rivalry more generally) and current educational investments, while (in parallel to Scheve and Stasavage), the correlation between wars and democracy is more tenuous. In addition, we find that the effect of military rivalry on educational investment is larger in democracies, something possibly quite specific to education. Also, in contrast to this literature, we treat state capacity as exogenous, both in the theory part and in our empirical analysis.

We have organized the paper as follows. In Section 2, we describe three historical examples that speak to the relationship between military rivalry and education reforms. Section 3 presents our data, descriptive statistics, and empirical specification. In Section 4, we describe the econometric results and discuss their robustness to a variety of factual and statistical concerns. In Section 5, we lay out a simple model that rationalizes our main empirical findings. Section 6 concludes.

2 Lessons From History

While each national history has unique elements that cannot be forced into a unified framework, the examples of France and Japan over the 19th century suggest a relationship between military defeats or rivalry and educational reforms. For each of these two examples, we describe the historical context, the debate that emerged due to a volatile international environment, and the subsequent education reforms with a particular focus on primary enrollment.

2.1 Jules Ferry's France

Background In 1870, French public expenditure on education were lagging behind that of Prussia and other European countries. The French education system was mainly private, largely revolving around churches. Teaching was done by priests or more casually by anyone around (be it the baker, the butcher,..), who knew how to read. Classrooms were often improvised

in the backyard of a farm, with poor equipment and amenities. And a large fraction of registered children never attended school. The result was that a large fraction of the population was either illiterate or unable to understand the content of a text. In 1863, 7.5 million citizens (about a fifth of the French population) could not even speak French properly but only local dialects.

Even prior to the war with Prussia in 1870, French elites were aware of the fact that the French education system had failed to promote national unity. Victor Duruy, appointed Minister of Education in 1863 by Napoleon III, was already advocating sweeping educational reforms, the improvement of educational facilities, and the development of technical education. His plans were in many ways similar to those that Jules Ferry would pursue some 20 years later[4]. Duruy tried to gather political support and convince the Emperor that it was in his own interest to implement such a reform. But he did not succeed, partly due to a lack of support from a rural population influenced by the Church.[5]

The turning point was the French defeat against Prussia in 1870. On September 2, 1870, Napoleon III was made prisoner at Sedan, and on February 26, 1871, Germany took control of the French regions of Alsace and Lorraine. This resounding defeat prompted the fall of the Second Empire and helped trigger the subsequent educational reforms by the leaders of the Third Republic.

The Reform Process After the Sedan defeat, the debate would continue between conservatives forces opposing and progressive forces supporting educational reforms, even though the balance of power had shifted towards the latter. While the conservatives led by the Church would see Sedan as a punishment for France's infidelity to its old (monarchical) traditions, the progressives saw Sedan as a reflection of the superiority of Prussian schools and

[4] "Duruy's major objective was to make primary education compulsory and tuition free so that each citizen could fulfill his duties under universal suffrage and contribute to the burgeoning economy" (Moody, 1978, p. 72).

[5] "In a letter to the Emperor on 6 February 1866, [Duruy] maintained that his plan would embarrass the Orleanists, the clericals and the republicans, and win millions of families to the Empire, particularly the parents of the million and a half pupils who were now accepted free, but under the stigma of charity" (Moody, p. 72). In fact, Duruy never managed to reduce the hostility of the rural masses, who looked on farm labor as a natural apprenticeship, and consequently Napoleon decided to let the project of his minister be defeated by the legislature.

university system.[6] Overall, even though groups and political parties would still disagree on the causes of military defeat, a majority of them agreed that education in Prussia had played a key role in the rise of this new power, and that education in France had to be reformed, not only to increase literacy, but also to acquaint new generations with basic knowledge in arithmetics, 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).

Jules Ferry was appointed the new Minister of Education in February 1879. In 1881, he abolished all tuitions fees in public elementary schools; in 1882, he made school enrollment compulsory from age six to thirteen; in 1883, it became compulsory for every village with more than twenty children at school age to host a public elementary school; in 1885, subsidies were devoted to the building and maintenance of schools and to paying teachers; and in 1886, an elementary teaching program was established, together with monitoring provisions. These are the so-called "Laic Laws", which still characterize the French educational system today. At the same time, a whole

[6] "Unexpected defeat, occupation, and sanguinary civil war fixed 1870-71 in the French consciousness as 'the terrible year.' Several national myths were deposed, end of the vision of national glory built during the Second Empire. [...] Frenchmen who had lived through the experience were aware that defeat had exacerbated the social and political divisions of the nation – the Commune provided brutal evidence. But intellectual disagreements were also sharpened as Frenchmen sought for a cause of the disasters that had befallen them. [...] There was a debate about the source of the defeat: the prime culprit was the Empire and all its works. The right viewed Sedan as deserved punishment for infidelity to the traditions of France. Toward the Church there was an initial ambivalence. Most people thought that 'France had neglected intellectual formation, particularly in the sciences [...].' 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 Iena. 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, p. 87).

infrastructure program – the Freycinet plan – was initiated to facilitate children's access to schools. Millions of francs were spent on building roads to match the large amounts spent on schools: 17,320 new schools had to be built, 5,428 schools were enlarged, 8,381 schools were repaired.[7]As a result, enrollment as well as attendance in primary education steadily increased.

The reforms not only generalized the access to schooling, but also transformed the content of elementary education: new programs emphasized geography, history, and dictation. The new teaching programs in history and geography aimed at conveying patriotic values to new generations. As for dictations, they were useful to teach people 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).

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."

The Outcomes Official statistics attest that school attendance rose appreciably in the decade after 1882. Primary enrollment rates went up from 1,176 per 10,000 inhabitants in 1870 to 1,430 in 1912. Literacy rates rose from 80% in 1870 to 96% in 1912 (and the initial 80% figure is partly misleading, as most supposedly literate children did not understand the content of what they read prior to the reforms). 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), and in that respect Ferry's efforts paid off during the subsequent mobilization in 1914.

[7]Source: Weber, E (1979), Peasants into Frenchmen : The Modernization of Rural France, 1870-1914 , Chatto & Windus.

2.2 Japan in the Meiji Era

Background From the 17th century, Japan was ruled by military lords (the so-called *shoguns*) of the Tokugawa dynasty. Under the Tokugawa, education was a privilege of the Samurais and centered on tradition and the study of Confucian classics. However, starting in the mid 1850s, Japan came under threats by Western powers. In 1853, Commodore Matthew Perry from the US arrived in Japan with an ultimatum to the authorities: agree to trade or suffer the consequences of war. To add credibility to this threat, American warships were sent to Japan in 1854. Subsequently, the Trade Convention of Kanagawa was signed on 31 March, 1854. The threats posed to Japan by Western powers in the second half of the 19th century acted as a catalyst for educational reforms. As put by Duke:

> "In 1872, government leaders were haunted by a crisis of international proportions. Powerful western nations were expanding trading posts throughout the world. 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 from the early 1600s, 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 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 at the beginning of the 1860s, but did not go far enough to satisfy the Samurais. As a result, Japan fell into civil war. In early January 1868, the insurgents prompted the Emperor Meiji, who had just taken the throne, to announce an "imperial restoration," which in fact was nothing less than a coup d'Etat.

The Reform Process The education debate featured the opposition between those who wanted to preserve the focus on Confucian classics and maintain interpersonal hierarchical relationships, and those who wanted to

introduce secular Western science with more mathematical thinking to catch up with Western technology. This debate fed a broader political crisis, culminating with the civil war. Following the imperial restoration", Western-oriented progressives eventually prevailed over Eastern-oriented traditionalists. The newly founded Ministry of Education sent delegates to the West to learn about their education system, for instance with the Iwakura mission of 1872-1873.

To rise up to the challenges posed by the West, in 1872, a new education system was instituted which declared 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.

The Outcomes Initially, reactions to the educational reform were mixed.

> "Not everyone was so happy at the obligation to attend school and the opportunity to graduate. The elementary schools were to be financed by a 10 percent local surcharge to the national property tax. 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. This represented close to one-tenth of the total number of schools. 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 to the educational reforms reflected a lack of democracy in the Japanese system – the peasants did not identify with the emperor, nor with the new ruling class, and therefore disapproved of the nationalistic education that was now compulsory. Similarly, people at first tried to resist the military reform.

Yet, over time, the Japanese educational reforms appeared more and more a resounding success. Japan overtook most European powers with regard to primary enrollment per school-age child, which rose from 28.1% in 1873 to 98.1% in 1910. From 1865 to 1910, the literacy rate increased from 35% to 75% for men and from 8% to 68% for women. The primary-school enrollment per 10,000 inhabitants rose with blistering speed, from 65 in 1876 to 1,122 in 1905.

The success of education reforms certainly played a role in the unexpected military victories by Japan in the 1895 war against China and the 1905 war against Russia. Overall, Japan's educational reforms during the Meiji era 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 the military considerations clearly took precedence over humanist ones. The popular resistance to the reforms may reflect the fact that a lack of democracy reduces the effectiveness of the educational reform.

2.3 Potential channels

There are several channels whereby primary education should be conducive to military success, and all of them appear to have been at work in France and Japan. A first channel is the acquisition of basic knowledge in calculus, reading and reasoning skills. A second channel is the acquisition of group discipline. A third channel is indoctrination and the transmission of patriotic values against neighboring countries. The empirical analysis of the relationship between primary enrollment and military wars or rivalry in the next sections does not distinguish between these channels.

3 Data and Empirical Specifications

3.1 Sources and Variable Definitions

Education To investigate the determinants of mass education reforms empirically, we use an unbalanced panel with annual data for 137 countries between 1830 and 2001. Our main dependent variable, *enrollment*, measures primary enrollment per capita. It is measured according to the UNESCO definiton of primary schooling and expressed per 10,000 inhabitants. 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. Since it is constructed as enrollment per capita, rather than enrollment per school-age child, this measure is affected by shifts in the demographic structure of the population: a younger population has, all things equal, a higher primary enrollment rate per capita than an older population. We therefore control for population growth in the previous 10 years to mitigate this concern. As shown in the descriptive statistics of Table 2, the average primary enrollment rate is 10.5% of the population over our pooled sample, with large variation across countries and time periods.

We also analyze the probability of education reforms, where reform is defined in two alternative ways. For the complete sample of countries, a binary *imputed reform* variable is set equal to one in a given year if primary enrollment grew by more than 10% over the previous 5-year period. When we perform the analysis of imputed reforms, we collapse the data into five-year averages so as to minimize measurement error. For a reduced sample of 14 European countries[8] (over the period 1830 to 1975), a binary *known reform* variable is set equal to one in years when new education reforms were adopted. The latter entail any new law which extends compulsory education, lowers the cost of education (e.g., abolish school fees, provide for free primary education), or increases the number of schools (e.g., by making 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.

War Threats We measure war risk and vulnerability to military threats in two alternative ways. Recent experience of external war is likely to raise the perceived likelihood of a new conflict and the salience of military concerns in policy decisions. Hence, our first variable *war risk* is a binary indicator set equal to one if the country was engaged in an interstate war in the previous 10 years, 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) measure of the number of casualties as a percentage of the pre-war population.

This measure of war risk is, of course, completely backward-looking and may therefore miss emerging threats without a history of war. Our second – and main – measure, *military rivalry*, is less subject to this concern.

[8] Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Norway, Sweden, Switzerland and United Kingdom.

Here, we define a dummy variable for whether a country has a strategic rival in a given year according to Thompson (2001). Thompson's measure captures the risk of armed conflict with a country of significant relative size and military strength. It is based on contemporary perceptions by political decision-makers, gathered through the investigation of historical sources on foreign policy and diplomacy. Specifically, military rivalries are identified by three criteria: whether two countries regard each other as "(a) competitors[9]; (b) a source of actual or latent threats that pose some possibility of becoming militarized; (c) enemies" (see Appendix A for details). 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 army sizes. To this end, we draw military personnel numbers from the COW National Material Capabilities database.

Summary statistics for war risk measures presented on Table 2 confirm that Thompson's rivalry variable captures a wider range of situations that the backward-looking past war variable. While the two are positively correlated, 16% of the country-year observations in our sample have experienced a war in the previous 10 years but almost half are associated with one or more strategic rivalries. Among observations where countries are engaged in strategic rivalries, a war has occured in the previous 10 years in 24% of the cases, and a war has been lost in 13% of the cases.

Political Regimes The political regime is constructed from the institutionalized autocracy and democracy scores in the Polity IV database (*polity2*

[9] "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. [...] Threatening enemies who are also adjudged to be competitors in some sense, as opposed to irritants or simply problems, are branded as rivals. This categorization is very much a social-psychological process. 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)

variable), which are themselves combinations of constraints on the executive, the openness and competitiveness of executive recruitment, and the 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. Of the country-years in the sample, about 43% have positive values of the democracy score. The mean score is -0.37 and the variance is 7.2, with strong variation both within and between countries; although political regimes often exhibit slow change, decomposition of variance actually reveals that around 36% of the total variance in democracy scores is due to the within component. One of the questions behind our empirical exercise will therefore be to determine whether such democratic political change or external rivalries appear to be the most significant drivers of mass education.

Covariates Finally, our regressions include several control variables. Military expenditure and total population are drawn from the COW National Material Capabilities. Measures of government expenditures per capita are from the World Development Indicators and CNTS databases. Other covariates used in robustness checks will be introduced in the relevant sections.

Table 1 about here

3.2 Specifications

Our baseline regression equation is expressed as:

$$\begin{aligned} enrollment_{i,t} &= \alpha_0 + \alpha_1 war\ risk_{i,t} + \alpha_2 democracy_{i,t} + \\ &\quad \alpha_3 war\ risk_{i,t} \cdot democracy_{i,t} + \alpha_4 X_{i,t} + \nu_i + \delta_t + u_{i,t}\ , \end{aligned} \tag{1}$$

where $enrollment_{i,t}$ refers to the primary enrollment rate in country i and year t. Our main coefficient of interest is α_1, which captures the effect of the war risk faced by country i in year t, and α_3, which captures its interaction with the political regime index. As explained above, this military threat is measured either by having at least one strategic rival in year t as defined above, or by having had a war some time in the past 10 years (i.e., between years $t-10$ and $t-1$). The variable $democracy_{i,t}$ is the democracy index in country i at time t. We also include a set of control variables $X_{i,t}$. Finally, and importantly, the specification entails 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.

To test the robustness of our results, we also estimate the probability of a discrete education reform according to the following Probit specification:

$$\begin{aligned} \Pr\left(reform_{i,t}\right) &= \beta_0 + \beta_1 war\ risk_{i,t} + \beta_2 democracy_{i,t} + \\ &\quad \beta_3 war\ risk_{i,t} \cdot democracy_{i,t} + \beta_4 X_{i,t} + \eta_i + \mu_t + v_{i,t}\ , \end{aligned} \tag{2}$$

where the $reform$ variable is either *imputed reforms* (for the entire sample of countries) or *known reforms* (for the historical European sample).

Our main prediction is that the coefficients which capture the effect of war risk on education policy should be positive. We exclude countries at war from the sample, as an ongoing war (as opposed to a latent rivalry) may severely increase the opportunity cost of public funds. Maybe more importantly, data in times of war may also be unreliable. The expected coefficient on democracy is not clear a priori. On the one hand, the median voter in a democracy may be poorer than in an autocracy and thus more favorable to mass education. On the other hand, a rent-seeking policymaker in an autocracy may be more likely to appropriate the future benefits of higher income due to education investments, and therefore more inclined to incur the cost of educational reforms than a democratic government.

4 Empirical results

4.1 Primary Enrollment Rates

Baseline Results Table 3 shows the results from our baseline estimation of (1) on the yearly panel, with primary enrollment rates as the dependent variable and war risk measured by the presence of an ongoing military rivalry in columns 1 to 3. 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. Indeed, we find that high population growth rates are consistently associated with higher primary enrollment per capita, while military spending – holding constant the level of external threats – has a negative coefficient. A natural interpretation of the latter is that fiscal capacity is limited, so that more effort towards building an army restricts the ability of the government to invest in mass education.

Column 1 shows that primary enrollment is positively and significantly associated with military rivalries. Interestingly, the coefficient on the democracy score is negative and highly significant. When faced with the same level of military threats, autocracies invest more in education than democracies. This finding runs counter to the median voter view of mass education reforms, which would predict better education outcomes in more democratic countries. Also, the coefficient on military rivalry remains stable as we control for the political regime, which appears inconsistent with the view that democratization *per se* would be the main underlying force behind increases in primary enrollment across countries.[10] In column 2, we add an interaction term to check if the impact of rivalries on educational investments differs by political regime. We find that primary enrollment responds more positively to military threats in democracies than in autocracies. We discuss the democracy results in Subsection 4.2 below.

Covariates In column 3, we include two covariates which may affect the education investment choice. The relative strength of rivals is defined as the military size of the sum of strategic rivals, divided by the size of the country's own military. A higher value of this variable signals a higher risk of losing a potential war. The point estimate suggests that countries with stronger rivals have higher enrollment rates, magnifying the effect of war threats for countries more likely to lose war if a war were to occur. We also control for total government expenditures per capita. Our main results are unchanged, namely the presence of a strategic rival is associated with higher enrollment in primary education, democracies have less primary education, while the interaction between the democracy indicator and military rivalry is positive.

Table 2 about here

[10]Interestingly, if we regress enrollment on democracy alone, we find a negative correlation once we control for both time and country fixed effects. Murtin and Wacziarg (2012) find a positive correlation between democracy and their enrollment variable in regressions that do not include those fixed effects. In our regressions with time and country fixed effects, the correlation between democracy and enrollment captures a *within-country effect relative to world average*. Our fixed effects estimator purges the effects of the level of democracy and instead captures the potential effect of changes in democracy on educational enrollment. It also eliminates potential sources of positive correlation between democracy and enrollment, for example that arising from the existence similar worldwide trends in the two variables.

Past Wars Instead of Rivalries Columns 4 to 6 present the same set of regressions, except that we replace military rivalry by the occurrence of a war in the past 10 years. Our main finding is that primary enrollment is positively correlated with the occurrence of a war in the past 10 years. Also, consistent with our previous set of results, we find that everything else equal, autocracies invest more in education than democracies (the coefficients on "democracy score" are always negative and significant). However the interaction term is insignificant in those specifications, as well as the severity of the recent war(s) as measured by the number of casualties incurred by the country as a percentage of its pre-war population.

4.2 Plausibity checks

The motive for investing in mass education in our narrative above, as well as our theory below, is that a more educated population is more effective at fighting wars. In this subsection we perform two plausibility checks supporting this narrative.

Education as a means to win future wars A first test is to look at the relationship between education, rivalries and future wars. The regressions are shown in Table 3. First, in the first two columns, the dependent variable is the probability (between 0 and 1) that a war will break out 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 further evidence that governments foreseeing a high war risk may increase education investments. Not surprisingly, there is also higher military expenditure in the run-up to a war. Next, in columns 3 and 4 the dependent variable is the probability of winning the next war, conditional on a war outbreak in the next 10 years. We do find that it is positively and significantly associated with current primary enrollment. Together with the historical evidence outlined in Section 2, these findings support the view that military threats spur investments in mass education in order to build more effective armies. None of the other covariates, including military expenditure, enters significantly in the regression for the outcome of future wars.

Table 3 about here

Military threats and military expenditure As a second check that education investments are indeed driven by military concerns, we run our baseline regression replacing education with military expenditure per capita as the left-hand side variable. As we can see in the last two columns of Table 3, we find the same pattern for military spending as we did for primary education enrollment: military spending responds positively to strategic rivalries and it is higher in less democratic countries.

4.3 The Political Regime

Our estimates are striking in that they imply that democratic countries invest less in primary education and pursue less education reforms than autocratic countries, absent rivalries or war threats. However, the gap between democracies and autocracies narrows when war risk is high.

The nature of the political system may affect education policy along several channels. As mentioned already in the introduction, extending the franchise might foster policies in the interest of the poor, which may include publicly funded primary schooling. But we find little evidence supporting this hypothesis. A prospective mechanism leading in the opposite direction is that democratically elected leaders have higher turnover – and therefore supposedly shorter time horizons – than autocrats, which may make the former less willing to invest in mass-education policies with mainly long-term benefits. A third channel could conceivably run through the effect of rivalries and wars on regime change: wars might affect education spending mainly because they promote regime change, which in turn affects education policy. However, our findings do not support this idea, since the direct estimates of military rivalry on education remains unchanged when we hold constant the political regime. Instead, our results suggest that war threats or past wars tilt the preferences of the elite towards mass education, even in autocratic regimes where more schooling might imply a higher risk of the leader being ousted.

While the positive interaction effect is an intriguing finding which remains to be understood, overall our analysis suggests that military competition between states has played a more important role for the emergence of mass education than has democratization. (Section 5 below gives an attempt of a theoretical rationalization.)

Disaggregating Democracy But maybe the concept of democracy is too broadbrush to help us understand the mechanisms at work. To make further progress, we try to disentangle the effects of two main components of the democracy score: constraints on the executive and the openness of executive recruitment. To this end, we thus run our main specifications, letting each of these two aspects of democracy enter separately on the right hand side. Specifically, we define one indicator variable for *high constraints on the executive* (*xconst* greater than or equal to 4 in the Polity IV database) and another for *openness of executive recruitment* (*xropen* greater than or equal to 3 in the same database).

Table 4 looks at 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 one particular aspect of democracy in Columns 2 and 4, both direct effects are negative and significant. The interactions with rivalry are both positive and statistically significant. In Columns 5 and 6, we perform a horse race between the two measures of democracy, with or without our interaction terms. The estimates show that the direct influence of each component of democracy remains, albeit with a larger and more significant interaction term for constraints on the executive.

Overall, both measures of democracy appear to matter. When interaction effects are taken into consideration, the direct relationship of both measures with primary schooling rates is negative, but it is mitigated or reversed in the presence of rivalries. In particular, the interaction between military threat and high executive constraints is always positive and significant. Although these disaggregated results do not shed too much light on the underlying mechanism whereby political regimes influence mass education, they demonstrate the robustness of the negative and significant correlation between the two measures of democracy and primary enrollment. [11]

Table 4 about here

[11] This is 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); yet, we consistenly find a negative and significant correlation between Polity indexes and primary schooling rates.

4.4 Instrumental Variable Estimation

We have established a positive relationship between military rivalry and primary education outcomes, as well as a positive interaction between rivalry and democracy, and we have found suggestive evidence that education helps improve the effectiveness of the military in future conflicts. However, the OLS regressions only reflect correlations and our identification strategy may suffer from a mix of reverse causality and omitted variables bias. For instance, consider a country trying to become more powerful on the international stage: it might invest in education to increase its chances of winning future wars and subsequently feel strong enough to engage in a series of rivalries. Thus, more "powerful" countries[12] may have better educated populations and engage in more rivalries, creating an upward bias in the coefficient of rivarly on education in our OLS regressions. Conversely, it is equally possible that our OLS coefficient is downwardly biased: if a country is "weak," and in particular has low levels of education, other countries might decide to target it and engage a rivalry with it.

In other words, a main concern regarding the identification of the causal effect of military rivalry on education outcomes is that rivalries and education outomes are both "choice variables" of a country and are necessarily correlated with its unobserved characteristics. We must therefore look for some exogenous variation in military rivalry. There is no perfect instrument in this respect, but we can use the exogenous component, from the perspective of a given country, of the competition between its neighbors.

The instrument Our instrument *inst_dummy* is a dummy variable constructed, for any country A, using information on the rivalries of all neighboring countries with countries different from A. More precisely, for any country A, *inst_dummy* is equal to 1 if one of its bordering countries B is engaged in a rivalry with at least one other country C that is not contiguous to A. Importantly, we only take into account neighboring countries B and their respective rivals C *that do not have a rivalry with country A*. Hence, *inst_dummy* measures "exogenous rivalries" that exist in the immediate regional environment of country A, between countries that have nothing to do with A in terms of rivalries. This measure of rivalry is much less of a choice variable for country

[12] "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.

A than the original measure of rivalry used in the OLS regressions, which mitigates the endogeneity problem. We show that in the data, *inst_ dummy* is a good predictor of the original rivalry variable for country A, suggesting that when its regional environment (exogenously) becomes more unstable, country A is morely likely to suffer rivalry. Obviously, this instrument is not perfect: country A presumably has some influence over bordering states B, so regional rivalries are not completely exogenous to A. [13]

In the regressions below, we also use the interaction of *inst_ dummy* with the democracy (polity2) score to instrument for the interaction term between military threats and democracy.

The data sample Turning to the data, the instrument is built for the entire country-year sample except for countries in Western Europe and the Eastern Bloc during the Cold War[14]. If we include Western Europe and the Eastern Bloc during the Cold War, the instruments become weak.[15] During these periods, this region was taken in a series of strategic alliances, such that regional rivalries cannot be taken as exogenous and the instrument does not have strong predictive power on rivalry. All IV regressions are run with heteroskedasticity-robust standard errors and various weak identification tests are reported (F-test of excluded instruments, Anderson-Rubin test, Cragg-Donald Wald statistic and Kleibergen-Paap Wald rk F statistic[16]).

[13] Although imperfect, our IV approach greatly mitigates the endogeneity problem of the OLS regressions. One main concern exists for the exclusion restriction: if country A is "weak", it might be more likely that countries B and C engage in rivalries since they know A will not react. On the other hand, if A is "strong," countries B and C may decide to avoid rivalries because they know A could react to stabilize the region. This effect would bias our IV estimates downward, i.e. we would underestimate the impact of military threats on schooling. However, it turns out that our IV regressions yield estimates larger than OLS, thus confirming that rivalries have a strong and significant effect on primary enrollment rates.

[14] The exact years excluded from the sample are: 1950 to 1990. Results are robust to resonably small changes in these bounds.

[15] These regressions are reported in the Web Appendix. The coefficient for rivalry on education is close to 5,000. See Stock and Yogo (2005) on weak instruments and biased IV estimators

[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. With one instrument, the Stock-Yogo weak ID test critical values are as follows:
10% maximal IV size: 16.38

Results We run IV regressions with either one instrument and one endogenous regressor (*rivalry*) or two instruments and two endogenous regressors (*rivalry* and *rivlary_polity2*). As shown in Table 5, the effect of rivalry on primary enrollment in the second stage is strongly significant and larger than in the OLS regressions (thus suggesting that the OLS coefficient was biased downward). The interaction between *rivalry* and *polity2* always enters positively and is significant as well. The various tests reject weak identification. Overall, the IV regressions suggest that military threats have a strong positive effect on primary enrollment [17] .

Table 5 about here

4.5 Extensions and Robustness Checks

In this section, we run a series of robustness checks to test the validity of our baseline results.All tables are available in the Web Appendix.

Education reforms In a first set of robustness checks, we consider the effect of war risk on the probability of an educational reform, based on the probit regression in (2). We first looks at the effects of military risk or rivalry on imputed reforms (i.e., a 10% or higher increase in primary enrollment over

15% maximal IV size: 8.96
20% maximal IV size : 6.66
With two instruments, they become:
10% maximal IV size: 7.03
15% maximal IV size: 4.58
20% maximal IV size: 3.95

[17] A potential concern with regard to the exogeneity restriction might be the existence of an "entanglement effect": namely, if the neighbor of country A is engaged in new rivalries, country A might be less concerned about going to war because its neighbor is entangled in potential future wars with other countries. The first stage regressions suggest that *inst_dummy* does not capture this effect since the instrument is positively correlated with future rivalry. We define a modified instrument, *riv_contig*, to take into account the entanglement effect: *riv_contig* is defined as the number of rivalries between bordering countries B and other countries C $\neq$A, weighted by the inverse of the distance between countries A and B in current year t. As before, we only take into account neighboring countries B and their respective rivals C that do not have a rivalry with country A. This approach yields estimates similar in magnitude to those obtained with the dummy. The results can be obtained from the authors.

a five-year period). Consistent with our predictions, we find that a strategic rivalry raises the probability of a large increase in primary enrollment. However, we find no significant impact of the military strength of rivals. The democracy index still enters negatively, and its interaction with rivalry is positive although not significant. Finally, neither population growth, nor total government expenditure, nor military expenditure, show significant coefficients when democracy is included in the regression.We have also checked the sensitivity of our results to the threshold of education expansion used to define imputed reforms. Specifically, we have used thresholds of 5% and 15% expansions in the last five years, instead of 10%. The signs of the coefficients on rivalry and on the democracy score are similar to those obtained with our baseline specification, although the interaction term between rivalries and democracy is no longer significant.

Second, we study the effect of military threats on known reforms which broaden access to primary or secondary education. We restrict our attention to the subsample of 14 European countries for which these data are available since 1830. The results are weaker than in the previous 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, or rival's military strength, on the probability of observing a reform in primary or secondary education, once we control for democracy.

Industrialization and Urbanization Besides the expansion of primary schooling and democratization, another important trend of the period considered is the move towards industrial and urbanized societies. Democracy may be correlated with the level of industrialization and urbanization. If an educated military is more valuable in more industrialized countries, where the army requires more skills, we may be concerned that our interaction term between rivalry and democracy is picking up this effect. In addition, as the expansion of industrial sectors relied on the development of human capital, manufacturers may have played a role in lobbying for education reform (Galor et al., 2009). To address these concerns, in the Web Appendix we add as control variables several measures of industrial development and their interaction with rivalry: the share of industrial activities in GDP (available for 1946-2000), 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 (drawn from Banks, 2011).

Most importantly, our results on democracy are unchanged: its direct coefficient is negative, its interaction with rivalry is positive, and both are significant. Moreover, as expected, more industrialized and more urbanized countries have higher rates of primary enrollment. 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 which has a score of 0 on the *polity2* scale, the point estimates suggest that the effect of military rivalry on primary education becomes positive around a 20% share of industry in value added, or around a 10% share of population living in cities of at least 50,000 people. In short, rivalry is positively associated with primary enrollment except for the least urbanized and least industrialized countries.

Other Covariates and Sample Selection We perform several other robustness tests on our baseline specification in the Web Appendix. There, 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 higher enrollment rates, but the effect of rivalry on primary enrollment decreases with ethnic fractionalization. Yet, our main coefficients remain unaffected. Then, we include the primary enrollment rate of the rival. Consistent with our intuition, the results show that countries increase their enrollment rates more when their rivals have more educated populations, and therefore presumably more effective armies. Also, we add 10-year lagged enrollment to control for initial conditions. As expected, primary enrollment displays high serial autocorrelation, but our main coefficients of interest are unchanged. Then, we 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. We also account for the possibility that country-specific factors may vary over the sample period, by interacting country fixed effects with dummies for before and after 1950. Finally, we add continent-specific time trends to the regression. Each time we find that primary enrollment rates are higher, all things equal, in countries engaged in a military rivalry, and that the effect of a rivalry is stronger in more democratic countries.

Other Robustness Tests We have performed other robustness tests as well, which are not reported here.[18] One is to compare our baseline results with those obtained with an alternative measure of primary schooling, namely education attainment from the Barro-Lee (2010) data set, available at five-year intervals for the postwar period only. We therefore ran the specifications of (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 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 3 – 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.

We also considered yet another measure of external threats, based on future conflicts. If countries correctly anticipate war risks, the incidence of future wars should proxy for military threats *ex ante*. This proxy is more vulnerable to endogeneity concerns than our rivalry or past war data, as the willingness to engage in wars can be influenced by past education levels. Despite this word of caution, it provides a useful check to our main hypothesis. We ran (1) measuring war risk by a binary variable that takes a value of one if and only if a war breaks out in the following 10 years. Our results are the same in the basic specification, namely: future wars enter positively in the enrollment regression, democracy enters negatively, and the interaction term is positive.

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.

[18] To save space, we do not show the corresponding regression results. These are available in the online appendix.

5 A Simple Theory

How can we understand the empirical results summarized at the end of the previous section? This is certainly not obvious, but in this section we propose a simple theoretical model that may help rationalize our main findings. In line with the historical discussion and the focus of our empirical work, the model highlights the prospective role of public education in the efficient operation of the military.

Basic Setup The formal model we develop borrows in spirit from the state-capacity framework of Besley and Persson (2009, 2011), from the voter participation frameworks by Feddersen and Sandroni (2002) and Coate and Conlin (2004), and from the analysis by Ticchi and Vindigni (2009) of fighting incentives across different political regimes. Consider a society, where the 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 and constant over time and normalized to $\frac{1}{2}$. 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 political institutions, we focus on the constraints on the executive. These 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 more democratic institutions in the sense of higher checks and balances (protecting opposition groups from discretionary redistribution). A war can occur in period 2 with exogenous probability p. For simplicity, all (accumulated) income perishes from the country as a whole – i.e., to both groups – if a war is lost.

The conditional 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 an individual specific utility cost that is decreasing in the level of education e. We assume a very simple cost function $\frac{x}{e}$, where variable x is individual-specific and uniformly distributed on $[0, 1]$ in each group.[19] Any individual in group J

[19] Here we abstract from the idea that an increase in primary education might also result in better outside options for people who previously had no education, which in turn would

will follow a behavioral rule to expend his unit of effort if $\frac{x}{e} < \frac{\omega_J}{e}$, where ω_J is the rule set by group J members, which 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).

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

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

where we assume that $\alpha < 1$. This formulation assumes that (aggregate) efforts of the two groups are complementary. 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. Another possibility is that the groups represent an dominant elite from which officers are drawn and a large non-elite from which common soldiers are drawn: again, effort is needed from both groups.

Thus, education in this basic model only serves to cut the cost of each individual's perceived fighting effort, but it is straightforward to let output depend on the level of education (see further below). The level of education is chosen by the incumbent group. Specifically, in period 1, the incumbent group can augment the initial education level, normalized at zero, by investment e in future education at 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.

tend to increase -not decrease- military costs. However, we do not see this as a major source of concern, especially since the overwhelming majority of countries in our sample were enforcing military conscription during the period we study. 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)

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. If a war has erupted, it is won with probability q.

5. If no war has erupted or a war has been won, the incumbent group consumes $1-\delta$, while the opposition group consumes δ.

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 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, group O solves

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

taking ω_I as given, while the incumbent group's effort solves

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

Simple algebra gives us:

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

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

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

[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.

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

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

The first-order condition becomes:

$$C'(e) = p(1-\delta)\frac{\partial q^*(e,\delta)}{\partial e} \ , \tag{3}$$

or

$$\gamma e^{\gamma-1} = \frac{p(1-\delta)}{2-\alpha}\left[\delta^{\frac{\alpha}{2-\alpha}}+(1-\delta)^{\frac{\alpha}{2-\alpha}}\right]e^{\frac{2(\alpha-1)}{2-\alpha}} \ ,$$

which implies equilibrium educational investment

$$e = \left\{\frac{p(1-\delta)}{\gamma\,(2-\alpha)}\left[\delta^{\frac{\alpha}{2-\alpha}}+(1-\delta)^{\frac{\alpha}{2-\alpha}}\right]\right\}^{\frac{2-\alpha}{(\gamma-1)(2-\alpha)+2(1-\alpha)}} . \tag{4}$$

Equation (4) immediately implies that for γ sufficiently large the expression $q^*(e,\delta) = \frac{1}{\alpha}e^{\frac{\alpha}{2-\alpha}}\left[\delta^{\frac{\alpha}{2-\alpha}}+(1-\delta)^{\frac{\alpha}{2-\alpha}}\right]$ strictly lies between 0 and 1, as claimed earlier.

Comparative Statics One can now show:

Proposition 1 *For δ small enough and γ large enough that we do not run into corners, equilibrium investment in education e, is increasing in the risk of war, p, and positively affected by the interaction between democracy δ and the risk of war p, namely: $\frac{\partial e}{\partial p}>0$ and $\frac{\partial^2 e}{\partial p\partial\delta}>0$.*

Proof. Part 1 follows straightforwardly from (4); Part 2 follows from the fact that:

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

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 in the RHS of the above equation remains bounded when $\delta \to 0$ whereas the second term becomes arbitrarily large. This establishes the Proposition. ■

Intuitively, these results of our model capture a relatively simple idea. 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 democracy in the form of some checks and balances, 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.

As it stands, the above model does not predict different signs for the direct effect of democracy on education $\frac{\partial e}{\partial \delta}$ and the interaction effect $\frac{\partial^2 e}{\partial p \partial \delta}$. However, once we allow output y to also depend positively on education, then the direct effect of democracy can become negative. For example, suppose that $y = y(e) = 1 + \beta e$, with β small. For small enough β, it is still the case (by continuity) that for sufficiently low δ : $\frac{\partial e}{\partial p} > 0$ and $\frac{\partial^2 e}{\partial p \partial \delta} > 0$. But in addition, we also obtain $\frac{\partial e}{\partial \delta} < 0$. To see the latter, note that in the extended model, the first-order condition for e becomes

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

where $y'(e) = \beta > 0$.

In the absence of military rivalry, i.e., for $p = 0$, we can write equilibrium educational investment as

$$e = \left[\frac{(1-\delta)\beta}{\gamma}\right]^{\frac{1}{\gamma-1}} \ .$$

Clearly, education is now decreasing in democracy parameter δ. By continuity, the results remains true for p sufficiently small.

Intuitively, democracy has a direct negative effect on the motives to invest in education, simply because stronger checks and balances reduce the incumbent's residual claim on the additional output generated by education.

An Auxiliary Prediction The unverifiable and complementary decisions on fighting effort by the two groups are the drivers of the model's positive interaction effect between military threats and democracy. But for other types of physical investments, their contribution to military success presumably depend less on such efforts. Following this logic, military rivalry might affect other measures of state capacity such as infrastructure, but the interaction between rivalry and democracy should be less significant. We confront this auxiliary prediction of the model with data on the length of paved roads from Calderón and Servén (2010), which covers 97 countries over the period 1960-2000. Table 15 shows the results of estimating our main specification with the yearly percentage change in the length of paved roads as the left-hand side variable. While military rivalries still drive this type of investment, we find no effect – neither directly nor through the interaction term – of the political regime 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. Democratization does not seem to play an important role, even though primary enrollment appears to respond more to threats in democracies than in autocracies. Moreover, a more severe war, as measured by a higher number of casualties, tends to magnify the impact of recent wars on education, whereas the impact of military rivalry on primary education is larger in more industrialized countries and in those facing stronger and more educated rivals.

Our approach could be extended in several directions. A first extension would be to look at the effect of military rivalry on other types of public investments, not just in primary education. For example, one could look at how much current or past military rivalry affects future fiscal capacity. Also, one could look at the potential effect of military rivalry on other educational variables. We performed some preliminary regressions using Barro-Lee data

on secondary school enrollment and find a positive correlation between this variable and military rivalry (only) when restricting attention to countries with high per capita GDP.

A second extension would be to investigate whether 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 on educational enrollment and other types of public investments (research spending, ..) as military rivalry.

A third extension is to look at the potential effects of civil wars and compare them with the effects of inter-country wars. Preliminary regressions can be performed using cross-country panel data from the Center for Systemic Peace on "Major episodes of political violence" for the period 1946-2008. For each year, we excluded the countries at war or in a civil war during the current year. Our findings can be summarized as follows: (a) if we use the continuous index "$civviol10$" to measure the degree of civil violence and civil warfare over the past 10 years, we find positive and significant correlations between that index and our measure of primary enrollment, but no effect of the interaction between civil violence and democracy; (b) if we use a dummy for the occurrence of a civil war in the past 10 years, we find no significant correlation at all.

A fourth extension would be to look more closely at the correlation between enrollment and past wars, and in particular to distinguish 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. And the correlation appears stronger if the war was won than if it was lost. This finding goes against the view that past wars might favor future education investments because defeats weaken incumbent elites that might oppose mass education. But explaining it goes beyond the scope of this paper.[21]

[21] One might think of several reasons for this correlation between a won war and a future increase in primary enrollment. First, it might be the case that after a war is won, the bargaining power of a country'se population increases, at the expense of that of the elite: the elite has to compensate the masses for their sacrifices during the war. European colonies during the interwar period, and even more so after the Second World War with the decolonization movement, seem to be a case in point. Other historical examples suggest that those who fought in a war get to be compensated. For instance, the 1944 G.I. Bill in the US provided various benefits to WWII veterans, including living expenses as well as

A fourth extension would be to consider the see whether the consider not only the size of primary enrollment, but also the governance of primary (and secondary) schools. Recent work by Algan, Cahuc and Shleifer (2011) distinguishes vertical and horizontal school pedagogy, where the former relies heavily upon taking notes from the teacher, whereas the latter involves group interactions among students. Our conjecture is that primary-education reforms primarily driven by past military rivalry, should put vertical systems in place, which may prevail still today.

Investigating these and other extensions in depth, is left for future research.

tuitions to attend high school, college and vocational training. Also, a won war might result in an increase in education enrollment due to a "positive feedback loop": the elite educates the masses, wages wars and military victories confirm that education of the masses was a good investment. Historically, Japan seems to illustrate this mechanism. Finally, the correlation between won wars and primary enrollment might stem from omitted variables. For example, consider a group of countries engaged in a "world expansion strategy". Primary enrollment in these countries might increase because of economic factors (such as the second industrial revolution in the case of European countries in the late 19th century), and at the same time wars are won abroad against minor countries that become colonized. In this case, military rivalry is not causing the increase in primary enrollment; rather, the country's "world expansion strategy" is causing both an increase in primary enrollment and military victories.

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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."

B Tables

Table 1: Summary Statistics (yearly data)

Variable	Obs	Mean	Std. Dev.	Min	Max
Enrollment per 10,000	6919	1054.473	528.125	1	3023
Rivalry	6919	0.494	0.500	0	1
Rel. army largest rival	6339	1.097	2.765	0	56
Rel. army total rivals	6339	1.642	4.299	0	59
War in previous 10 years	6919	0.159	0.366	0	1
War casualties	6919	0.055	0.337	0	7.932
Democracy index	6919	-0.367	7.120	-10	10
Population growth (10 yrs)	5391	19.312	14.889	-53.650	178.522
Military expenditure p.c.	6175	48.257	219.301	0	7398.568
Govt expenditure p.c.	6342	162.459	539.483	0.310	8402.080
Income tax	4187	0.684	0.465	0	1
GDP p.c.	4150	1563.041	3543.890	18	38344.930

Note: Unbalanced panel of 163 countries over the period 1830-2001.

Table 2: Primary Enrollment and War Risk

	Rate of primary enrollment					
	Strategic Rivalry			War in previous 10 years		
	(1)	(2)	(3)	(4)	(5)	(6)
Rivalry	54.878***	94.127***	63.369***			
	[17.835]	[17.904]	[20.290]			
War in				101.970***	106.019***	63.784***
previous 10 years				[15.667]	[15.962]	[17.000]
Democracy index	-6.871***	-17.632***	-17.976***	-7.276***	-6.929***	-6.261***
	[1.154]	[1.475]	[1.500]	[1.150]	[1.179]	[1.180]
Rivalry*Democracy		22.276***	22.434***			
		[1.945]	[2.078]			
War in 10 years					-2.736	-0.089
*Democracy					[2.068]	[2.122]
Rel. army total rivals			4.090***			
			[1.546]			
War casualties						32.796
						[20.825]
Govt expenditure p.c.			-0.250***			-0.273***
			[0.014]			[0.013]
Population growth.	9.424***	8.814***	8.964***	9.573***	9.543***	8.878***
	[0.489]	[0.485]	[0.544]	[0.487]	[0.487]	[0.488]
Military expenditure p.c.	-0.899***	-0.885***	-0.337***	-0.916***	-0.921***	-0.121*
	[0.050]	[0.049]	[0.080]	[0.050]	[0.050]	[0.066]
Observations	4,626	4,626	3,985	4,626	4,626	4,297
R-squared	0.669	0.679	0.721	0.671	0.672	0.700

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 per capita	
	(1)	(2)	(3)	(4)	(5)	(6)
Primary enrollment per 10,000	0.001***	0.001***	0.002***	0.003***		
	[0.000]	[0.000]	[0.000]	[0.001]		
Democracy score	0.010	0.038***	0.043	-0.036	-4.192***	-4.261***
	[0.007]	[0.009]	[0.036]	[0.053]	[0.708]	[0.854]
Rivalry	1.390***	1.551***		-10.209	31.162***	31.388***
	[0.121]	[0.150]		[150.234]	[10.704]	[10.817]
Rivalry*Democracy						0.168
						[1.153]
Military expenditure p.c.		0.002***	-0.001	-0.000		
		[0.000]	[0.001]	[0.001]		
Population growth		-0.021***		0.003	-1.275***	-1.277***
		[0.004]		[0.008]	[0.258]	[0.258]
Observations	3,383	2,385	514	389	8,247	8,247
R-squared					0.442	0.442

All specifications regressions and include country and time fixed effects. Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. Columns (1) to (4) are Probit regressions, Columns (5) and (6) are OLS regressions. 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. In columns (5) and (6), the dependent variable is military expenditure per capita.

Table 4: Components of Democracy

	Primary enrollment rate					
	(1)	(2)	(3)	(4)	(5)	(6)
Rivalry	60.504***	-20.492	52.045***	-16.601	53.823***	-65.918**
	[17.897]	[19.754]	[17.945]	[32.061]	[17.930]	[32.288]
Exec. constraints	44.552***	-89.388***			54.146***	-74.782***
	[15.573]	[21.118]			[15.704]	[21.407]
Exec. const.*Rivalry		245.543***				233.322***
		[26.448]				[26.639]
Exec. openness			-68.595***	-113.841***	-77.540***	-93.790***
			[17.981]	[25.095]	[18.145]	[25.188]
Exec. open.*Rivalry				85.245***		54.468*
				[33.003]		[32.861]
Population growth	9.145***	8.561***	9.254***	9.235***	9.177***	8.605***
	[0.490]	[0.490]	[0.489]	[0.489]	[0.489]	[0.489]
Military expenditure p.c.	-0.873***	-0.871***	-0.882***	-0.878***	-0.869***	-0.865***
	[0.050]	[0.050]	[0.050]	[0.050]	[0.050]	[0.050]
Observations	4,626	4,626	4,626	4,626	4,626	4,626
R-squared	0.667	0.673	0.667	0.668	0.668	0.675

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: IV Regressions

Panel A: First Stage Regressions

	(1)	(2)	(3)
1st Stage	riv	riv	riv_polity2
inst_dummy	0.13137***	0.12924***	-0.46060*
	[0.024]	[0.024]	[0.249]
inst_dummy_polity2		0.00198	0.30499***
		[0.002]	[0.025]
polity2	-0.00200*	-0.00353*	0.27597***
	[0.001]	[0.002]	[0.024]
govexp	0.00002	0.00002	-0.00011
	[0.000]	[0.000]	[0.000]
popgrowth	-0.00005	-0.00009	0.02428***
	[0.000]	[0.000]	[0.004]
milexpop	0.00011***	0.00011**	0.00062
	[0.000]	[0.000]	[0.000]
Excluded Instruments	inst_dummy	inst_dummy inst_dummy_polity2	inst_dummy inst_dummy_polit
F-statistic of Excluded Instruments	31.10	17.04	76.26
Observations	3,760	3,760	3,760
Country Fixed Effects	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes
R^2	0.838	0.838	0.839

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

Table 5: IV Regressions

Panel B: Second Stage Regressions

	Primary enrollment rate	
2nd Stage	(1)	(2)
riv	837.14443***	860.12700***
	[221.008]	[220.624]
riv_polity2		22.87119***
		[8.376]
polity2	-0.35309	-12.01952***
	[1.512]	[4.525]
govexp	-0.30204***	-0.29211***
	[0.028]	[0.028]
popgrowth	7.13535***	6.46019***
	[0.700]	[0.736]
milexpop	-0.01412	-0.03534
	[0.127]	[0.129]
Endogenous Regressors	riv	riv
		riv_polity2
Instruments	inst_dummy	inst_dummy
		inst_dummy_polity2
Anderson-Rubin Wald test	23.86	37.60
Cragg-Donald Wald F statistic	62.154	30.190
Kleibergen-Paap Wald rk F statistic	31.100	14.652
Observations	3,760	3,760
Country Fixed Effects	Yes	Yes
Time Fixed Effects	Yes	Yes

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

Table 6: Road Investments, Rivalry and Democracy

	% change in length of paved roads			
	(1)	(2)	(3)	(4)
Rivalry	1.856**	1.801**	1.732**	1.879**
	[0.859]	[0.853]	[0.862]	[0.861]
Polity2		0.035	0.059	0.034
		[0.053]	[0.068]	[0.071]
Rivalry*Polity2			-0.051	-0.048
			[0.089]	[0.090]
Real GDP				4.149*
				[2.465]
Military expenditure p.c.	0.003	0.004**	0.004**	0.005*
	[0.002]	[0.002]	[0.002]	[0.003]
Observations	9113	8283	8283	6914
R-squared	0.451	0.442	0.442	0.684

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

C Online Appendix

Table XX: IV Regressions

Panel A: First Stage Regressions

	(1)	(2)	(3)
1st Stage	riv	riv	riv_polity2
inst_dummy	0.04714**	0.05096**	-0.74445***
	[0.021]	[0.023]	[0.203]
inst_dummy_polity2		-0.00183	0.28759***
		[0.002]	[0.022]
polity2	-0.00466***	-0.00337	0.29417***
	[0.001]	[0.002]	[0.020]
govexp	0.00001	0.00001	-0.00030***
	[0.000]	[0.000]	[0.000]
popgrowth	0.00063*	0.00067*	0.02609***
	[0.000]	[0.000]	[0.004]
milexpop	0.00004	0.00004	0.00097**
	[0.000]	[0.000]	[0.000]
Excluded Instruments	inst_dummy	inst_dummy inst_dummy_polity2	inst_dummy inst_dummy_polit
F-statistic of Excluded Instruments	4.91	2.47	87.49
Observations	4,220	4,220	4,220
Country Fixed Effects	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes
R^2	0.781	0.781	0.811

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

Table XX: IV Regressions

Panel B: Second Stage Regressions

	Primary enrollment rate	
2nd Stage	primenr	primenr
riv	5,114.65020**	5,373.77194**
	[2,312.528]	[2,409.759]
riv_polity2		86.12937**
		[41.827]
polity2	17.72724	-24.00761
	[12.782]	[24.408]
govexp	-0.31113***	-0.26420***
	[0.053]	[0.059]
popgrowth	5.19118**	2.18842
	[2.487]	[3.148]
milexpop	-0.32542	-0.41841
	[0.246]	[0.264]
Endogenous Regressors	riv	riv
		riv_polity2
Instruments	inst_dummy	inst_dummy
		inst_dummy_polity2
Anderson-Rubin Wald test	151.21	200.93
Cragg-Donald Wald F statistic	9.500	4.612
Kleibergen-Paap Wald rk F statistic	4.912	2.450
Observations	4,220	4,220
Country Fixed Effects	Yes	Yes
Time Fixed Effects	Yes	Yes

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

Table XX: Robustness: Education Reforms and Military Rivalry

Panel A: Imputed reforms

	Probit for "imputed reforms"			
	(1)	(2)	(3)	(4)
Rivalry	0.271**	0.177	0.190*	0.379***
	[0.119]	[0.113]	[0.113]	[0.145]
Polity2		-0.055***	-0.059***	-0.061***
		[0.007]	[0.010]	[0.010]
Rivalry*Polity2			0.009	0.013
			[0.014]	[0.017]
Rel. army total rivals				-0.005
				[0.019]
Population growth.	0.009***	0.004	0.004	0.003
	[0.003]	[0.003]	[0.003]	[0.003]
Military expenditure p.c.	-0.001**	-0.001**	-0.001**	-0.001
	[0.000]	[0.000]	[0.000]	[0.000]
Observations	1390	1299	1299	1163

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

Table XX: Robustness: Education Reforms and Military Rivalry
Panel B: Known reforms

	Probit for "known reforms"			
	(1)	(2)	(3)	(4)
Rivalry	0.233***	0.235**	-0.111	-0.021
	[0.085]	[0.092]	[0.237]	[0.213]
Polity2		0.005	-0.000	-0.000
		[0.013]	[0.023]	[0.022]
Rivalry*Polity2			0.040	0.028
			[0.034]	[0.026]
Rel. army total rivals			0.074***	0.095***
			[0.016]	[0.018]
Govt expenditure p.c.				0.000
				[0.001]
Population growth	-0.001	-0.000	0.009	0.009
	[0.009]	[0.009]	[0.008]	[0.013]
Military expenditure p.c.	0.000	0.000	0.001	0.001
Observations	881	880	852	798

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

Table XX: Robustness: Industrialization and Urbanization

	Primary enrollment rate					
	(1)	(2)	(3)	(4)	(5)	(6)
Rivalry	46.696**	-206.815***	123.750***	-224.838***	91.071***	-350.082***
	[21.212]	[42.090]	[18.273]	[29.907]	[18.637]	[31.797]
Polity2	-4.435***	-5.266***	-21.407***	-11.426***	-23.061***	-12.288***
	[1.681]	[1.669]	[1.537]	[1.647]	[1.548]	[1.623]
Rivalry*polity2	4.261**	4.744**	24.061***	12.233***	26.393***	13.889***
	[2.045]	[2.027]	[1.996]	[2.108]	[2.014]	[2.078]
Industry/GDP	8.187***	3.293***				
	[0.909]	[1.143]				
Riv.*industry/GDP		8.209***				
		[1.181]				
% Urban (50,000)			9.066***	-1.547		
			[0.915]	[1.153]		
Riv.*% urban (50,000)				15.330***		
				[1.057]		
% Urban (20,000)					6.470***	-1.963**
					[0.764]	[0.890]
Riv.*% urban (20,000)						13.850***
						[0.824]
Population growth	4.012***	4.087***	9.272***	9.034***	8.323***	7.708***
	[0.557]	[0.552]	[0.511]	[0.498]	[0.522]	[0.505]
Military expenditure p.c.	-0.318***	-0.319***	-0.936***	-0.966***	-1.337***	-1.332***
	[0.043]	[0.043]	[0.065]	[0.064]	[0.080]	[0.077]
Observations	2,675	2,675	4,112	4,112	3,927	3,927
R-squared	0.797	0.801	0.721	0.736	0.727	0.747

All specifications regressions and include country and time fixed effects. Robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. "% Urban (50,000)" is the share of the population living in cities of 50,000 or more inhabitants (in %) and "% Urban (20,000)" is the share of the population living in cities of 20,000 or more inhabitants (in %). "Industry/GDP" is the share of industrial output in GDP (in %).

Table XX: Robustness: Specification and Sample Selection

	Primary enrollment rate					
	(1)	(2)	(3)	(4)	(5)	(6)
Rivalry	235.331***	162.249	99.116***	185.977***	-67.439***	120.954***
	[50.843]	[146.363]	[14.915]	[22.597]	[16.656]	[16.402]
Polity2	-6.038***	-89.206***	-5.731***	-8.944***	13.295***	-2.503**
	[1.836]	[27.911]	[1.184]	[1.753]	[1.342]	[1.246]
Rivalry*polity2	2.733	92.965***	6.035***	14.514***	13.404***	7.689***
	[2.318]	[27.914]	[1.596]	[2.323]	[2.086]	[1.740]
Rel. army rivals		8.685***	-1.023	10.823***	10.922***	1.064
		[1.313]	[1.141]	[1.446]	[1.878]	[1.271]
Ethnic frac.	1,497.845***					
	[332.801]					
Ethnic frac*rivalry	-313.186***					
	[88.696]					
Prim. enrollment rivals		0.185***				
		[0.020]				
L10.prim.enrollment			0.806***			
			[0.015]			
Population growth	3.689***	8.957***	3.870***	7.650***	5.567***	5.717***
	[0.566]	[0.655]	[0.454]	[0.513]	[0.543]	[0.446]
Military expenditure p.c.	-0.330***	-0.532***	-0.204***	-0.634***	-0.349***	-0.217***
	[0.042]	[0.067]	[0.051]	[0.065]	[0.065]	[0.053]
Observations	2692	1952	3,857	3,094	4,275	4,165
R-squared	0.778	0.838	0.840	0.813	0.251	0.816

All specifications regressions and include country and time fixed effects. Standard errors in brackets. ***p<0.01,**p<0.05,*p<0.1. Column (1) includes the index of ethnic fractionalization from Alesina et al. (2003) and its interaction with rivalry; it covers only the period 1945-2001. Column (2) includes the primary enrollment rate of the largest rival if any. In column (3) "L10.prim.enrollment" is the 10-year lagged primary enrollment rate per 10,000 inhabitants. Column (4) excludes Western Europe. In column (5) country fixed effects are interacted with before/after 1950 dummies. Column (6) includes continent-specific time trends.