Long Run Determinants of European Violence, A.D. 500 – 1900.

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Abstract

In order to assess potential determinants of interpersonal violence across Europe over the very long run, we make use of a new indicator – regicide, the killing of kings. We find evidence for Eisner's (2011) hypothesis that the proportion of killed rulers closely approximates the prevalence of homicide within kingdoms, allowing us to study earlier periods for which homicide records are not available. Using linear probability models with time and country fixed-effects, we find evidence for Elias' (1939) 'civilising process', for Eastern Europe's 'Second Serfdom' and that climate, elite human capital and urbanisation are all negatively associated with regicide rates.

Keywords: regicide, elite human capital, 'Second Serfdom'

1. Introduction

Violent conflict has fashioned the world not only into the shapes constrained by the international borders that we now see in an atlas, but has also defined aspects of culture and institutions by which we live on a daily basis. It

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has drastically affected development, and contributed to the current global distribution of wealth and disparities in today's living standards. As a consequence, the absence of violence can be seen as a precondition for the development of social capital and hence, economic growth. Elias (1939) observed a centuries long decline in violence that he termed humankind's 'civilising process', which many scholars have declared decisive to the increase in living standards toward those of the modern era. Consequently, this paper investigates the potential effects of social, environmental and organisational determinants of long run violence.

Interpersonal violence is a challenging topic to study over the long run, particularly as homicide rates have become its measurement standard among economic historians. Homicide data does not usually extend further back in time than a few hundred years, even in countries with the most rigorous traditions of record-keeping. However, in this paper we follow the work of Eisner (2011) and make use of regicide - the killing of kings - in order to act as a proxy for interpersonal violence. We argue that using regicide as a proxy is possible due to the close relationship that homicide and regicide appear to share, and because of the theoretical links between the two measurements that evolutionary psychology and rational choice theory allow us to construct. Regicide data is also relatively easy to obtain due to the eagerness of chroniclers to independently document the lives of their rulers throughout the course of history. Because both their lives and causes of death have been well documented, we also have access to a reliable base rate with which to construct regicide rates (Eisner, 2011). Additionally, this habit of recording the lives and deaths of rulers allows for an analysis that begins far earlier than other indicators of interpersonal violence have traditionally allowed. Though our analysis begins in the 5^{th} century, using regicide potentially allows for an analysis from long before the common era.

Throughout this paper, we discuss questions such as, at what point in history did previously high levels of interpersonal violence begin to decline? What was this timing like in Eastern and Western Europe respectively? Did the 'Second Serfdom' matter and what were the reasons behind this observable decline in violence?

We first discuss the relationship between regicide and interpersonal violence from an evolutionary psychology and rational choice framework, before comparing trends between various indicators of interpersonal violence. We then

present regional trends in European regicide before finally conducting an empirical analysis into the potential effects of social, environmental and organisational determinants of long run violence, as well as investigating any role that the 'Second Serfdom' may have played.

2. The Relationship between Regicide and Homicide: Can we use the Killing of Rulers as a Proxy for Overall Homicide?

2.1. Evidence from Evolutionary Psychology and Rational Choice Theory

Though homicide is regarded as the academic standard when measuring interpersonal violence, its historical records only seem to begin in the 14^{th} century. Even then, they are only available for a small number of countries – namely, Italy, Germany, Spain and the United Kingdom – while records in most European countries only seem to begin in the 19^{th} century. Initially, homicide records began to be recorded by sovereign bodies because they were considered significant and unusual events, unlike more common aspects of life such as birth rates, agricultural production or trade volumes, data which usually appear later. However, we can imagine that these homicide figures would have initially suffered from reporting biases and would have been recorded long before population censuses, thereby confounding modern estimates of early homicide rates, as population figures still needed to be estimated.

Like homicide, regicide records were also collected because of their value as both significant and unusual events within societies, only more so than homicide. Accordingly, regicide records were amassed from much earlier times, providing economic historians with much longer datasets. Unlike early homicide records, regicide records have the advantage of near complete base rates due to comprehensive dynastic lists, as documenting rulers was deemed important regardless of whether or not they were killed.

The use of regicide as a proxy for interpersonal violence was first explored by Eisner (2011) who noticed a strong association between European homicide and regicide rates as far back as the 14^{th} century in Western Europe. Eisner (2011) also described regicide as a theoretically suitable proxy for interpersonal violence as follows. Firstly, regicide has been observed in all regions and over multiple centuries or even millennia, making it a suitable

instrument with which to study general themes in violence. Secondly, Eisner refers to the literature surrounding evolutionary psychology and rational choice theory, which conclude that the vast majority of interpersonal violence is not the result of dysfunctional aggression, but rather a rational means of solving specific adaptive problems (Buss and Shackelford, 1997; Duntley and Buss, 2004; Duntley and Shackelford, 2008; Frey, 2007; Eisner, 2009). Consequently, a theoretical link between regicide and interpersonal violence may lie in the rational strategies behind building armies, forming gangs or hiring assassins in order to obtain or influence vital resources such as land, tools, food or weapons for example.

Evolutionary psychology is based on Charles Darwin's (1859) theory of evolution through natural selection, and has been used to describe the relationships between psychology, crime and law (Duntley and Shackelford, 2008: 374). The theory first argues that humans have built in mechanisms that are prompted by external events, such as having to blink when an eye is threatened by a foreign object or even a puff of air (Buss and Shackelford, 1997: 607). Secondly, it proposes that all of these mechanisms, like the eyelid, have been developed through natural selection in order to serve their purpose with heightened efficiency. Based on these two assumptions – that behaviour requires the existence of these mechanisms and that the mechanisms are a result of a process of natural selection – the theory suggests that evolution plays a role in every instance of behaviour (Buss and Shackelford, 1997: 607).

Throughout our history as a species, human beings have repeatedly encountered the same adaptive problems – the reactions to which have affected our length and quality of life as well as reproductive capabilities. Individuals that were better at solving these problems tended to survive and reproduce, subsequently teaching the same behaviour to their offspring and shaping modern behaviour through evolutionary fitness (Duntley and Shackelford, 2008: 374). When observing the behaviour of other species, it is clear that violence is both widespread and effective in solving adaptive problems. Likewise, it has clearly been a common phenomenon among human beings throughout history. However, Duntley and Shackelford (2008) argue that as human beings are a relatively weak species physically – lacking immense size, horns, fangs, venom or poison for example – that cognitive adaptations have been particularly important to humans throughout our evolutionary history, and that cases of violent behaviour have therefore been far more nuanced and

strategic than among other species. Both Buss and Shackelford (1997: 608) and Duntley and Shackelford (2008) subsequently identify key factors which they argue compose the majority of adaptive problems for which violence has served as a solution. Therefore, if these adaptive problems can be linked to both regicide and homicide theoretically, we can conclude that the same evolutionary factors determine both of them; consequently expanding Eisner's (2011) evidence for regicide as a suitable proxy for interpersonal violence.

In a similar analysis, Frey (2007) constructs a model of rational choice that predicts political assassinations based on an equilibrium between the demand for these assassinations and their supply. He models demand by considering the reasons for killing a ruler or politician – largely using the same factors identified by Buss and Shackelford (1997) for interpersonal violence – and models supply by contemplating the countermeasures that the ruler had in place; the 'supply of opportunity' to kill a ruler. The supply factors that Frey (2007) uses are the number of bodyguards that a ruler employs, such as the Roman "Praetorian Guard", as well as 'material countermeasures' such as clearing crowds, using armoured vehicles or bullet proof vests for example. There are clearly similarities behind the motivations for killing both politicians and rulers, so the similarity in the responses to adaptive problems that are identified in both Frey (2007) and Buss and Shackelford (1997), also add to the body of evidence for regicide's appropriateness as a proxy for homicide.

However, we need to take care not to confuse evolutionary psychology with the "instinct theory of aggression". Instinct theory predicts that violent aspirations preside in all individuals and that these gradually inflate before the individual acts violently (Buss and Shackelford, 1997), rather than as a rational response meant to solve adaptive problems. Though this drive toward violent conduct is supposed to have been influenced by external factors under the "instinct theory" framework, its source is considered innate. Instinct theory was popular until the 1990s before psychologists rejected it entirely; with Myers (1993: 438) alleging that, "the idea that aggression is an instinct collapsed as the list of supposed human instincts grew to include nearly every conceivable human behavior... what the social scientists had tried to do was to explain social behavior by naming it". Consequently, the distinction between rational or evolutionary changes in violent behaviour should be distanced from those supposedly driven by instinct.

Additionally, modern psychological theories relating to violence often conclude that violent propensities in children are formed or at least exacerbated by modern and western cultural forces. For example, western culture often projects violent scenes onto children through TV or video games, or when they play with toy weapons (Berkowitz, 1993). Buss and Shackelford (1997) conclude that although these factors certainly do seem to increase violent propensities in children, that they cannot act as a complete theory of violence due to the relatively recent rise of western civilisation, leading to their support for the evolutionary psychology hypothesis.

The first of Buss and Shackelford's (1997) examples for which violence has been used as a solution to adaptive problems has been in order to "co-opt the resources of others". Humans have always employed resources such as land, tools, food, water and weapons; they have been both vital to our survival and key to increasing our living standards over time. As such, individuals are provided with the incentive to steal these resources or to co-opt them through aggression. This first example is easily applicable to regicide, as rulers control vast regions and possess large stores of tools, food, water and weapons. Though we do not have statements of intent from assassins throughout the course of history, it is clear that the prospect of obtaining said resources would have constituted a key incentive for regicide. When considering rulers, their power and influence should also be seen as resources potentially susceptible to annexation. Indeed, Eisner (2011: 564) argues that the majority of killed rulers were murdered by prospective successors – their own families or competing nobility for example – followed by other cases such as revolting citizens with personal or political vendettas. Further, as a ruler's power would have been a near unique and valuable resource, we would expect even greater incentives in order to co-opt it (Duntley and Shackelford, 2008).

As Frey (2007) examines political assassinations, he assesses policy responses to voter preferences and concludes that voter satisfaction is important in determining the probability of assassination. Additionally, he states that politicians are at lower risk of assassination in democracies where a civil society is strong and where a country's legislature, executive and judiciary are independent (Frey, 2007). Frey (2007) even refers Schumpeter's (1942) perfectly competitively democratic result where the policies of all political parties converge to the preferences of the median voter. In this model, there is no demand for assassination as killing a politician would have no effect on policy. Though monarchs throughout the course of history have had far more

flexibility in policy making than simply catering to the median voter, the core idea that the more popular a ruler's policies – particularly among elites who had access to more resources than peasants – the less likely an assassination attempt (Frey, 2007). Naturally, co-opting the resources of a ruler would have been more complicated than those of an individual; more risk is involved but there are also greater incentives to undertake such a task. As a result, the higher the perceived probability of co-opting resources or obtaining power, and the greater the number of participants that are predicted to benefit from these resources, the higher the chance of a successful regicide attempt.

Buss and Shackelford (1997) then discusses the use of violence in obtaining and sustaining one's status within a society, giving examples of ritual fights within tribes of the Ache and Yanomamo of Paraguay and Venezuela respectively. Attributes such as courage and power have always been seen as positive and have acted to elevate the social status of individuals within many cultural groups throughout history (Hill and Hurtado, 1996; Chagnon, 1983). Indeed, Alexander (1979) argues that since humans evolved from small and dispersed social structures, seemingly trivial attributes such as status and reputation were exceedingly important for survival and reproduction. However, we must note that evolutionary psychology cannot explain the variation between aggression among different individuals or why explain why certain acts of violence are seen to inflate social status by some and to reduce it by others (Buss and Shackelford, 1997). For example, a boxer's status is elevated by winning a boxing match while a manager at a company would suffer diminished social status if he or she were to fight the company's CEO. In the same way that violence has been used to further individual status, we can imagine that prospective rulers would have used it in order to garner both attention and support for their claims on positions within the succession hierarchy in order to avoid being overlooked. Buss and Shackelford (1997) propose that regicide related to the hierarchy of succession would therefore be more likely when the rules of succession are unclear or when the institutions that govern succession rules are weak. Consequently, we control for succession rules in our empirical analysis [1].

The third example describes how humans use aggression to defend themselves against attack from those who seek to co-opt their resources in the

[1]Note: This hypothesis has not yet been tested.

present, or to dissuade rivals from attempting to usurp their power in the future (Eisner, 2011). At the individual level, one may violently defend one's resources or adopt a hostile attitude to strangers in order to deter potential future attackers, as seen in attacks based in xenophobia or racism today. For example, migrant workers in South Africa have had to endure spates of attacks rooted in xenophobia, as locals enact vigilante style justice in response to the perception that foreigners are criminals and that – in the context of high unemployment and job scarcity – they have stolen jobs from the locals (Harris, 2002). For a ruler, excessive pre-emptive aggression may provoke another ruler into invading their realm; while oppressing their own inhabitants may elicit a negative reaction such as a revolution or a coup. Additionally, in the same way that foreign rulers may arrange the assassination of a ruler in order to sew chaos and potentially make it easier for them to co-opt the resources of another realm, a foreign power could also arrange such an assassination to pre-emptively protect themselves from future attacks through this chaos (Buss and Shackelford, 1997). This kind of a strategy would only work, however, if the assassination was kept secret and no revenge was enacted, particularly as the result that aggression begets more aggression is one of the most robust results of psychological research into violence (Berkowitz, 1993; Buss, 1961).

Lastly, Buss and Shackelford (1997) also provide examples in which violence has been used to solve adaptive relationship problems. These include conflicts between intra-sex rivals that pursue the same mate, violence that is used to discourage infidelity in existing relationships, and violence that is used to limit resources spent on unrelated children. In their study of American and Canadian households, Daly and Wilson (1988) found that this 'Cinderella effect' meant that children who lived with a step-parent were 40 to 100 times more likely to be murdered than those who lived with both biological parents. These examples, however, have little or no applicability to regicide and will not be discussed in detail as a result. However, the scope of the preceding adaptive problems which are solved through violent conduct suggest that at least a large proportion of interpersonal violence is indeed a rational and evolutionary response to context-specific situations. By discussing the ways in which interpersonal violence has been used to solve these problems, we have noted that the same patterns emerge when applying them to rulers and regicide. This theoretical link helps to explain the empirical and graphical results that will be shown and discussed in the sections that follow.

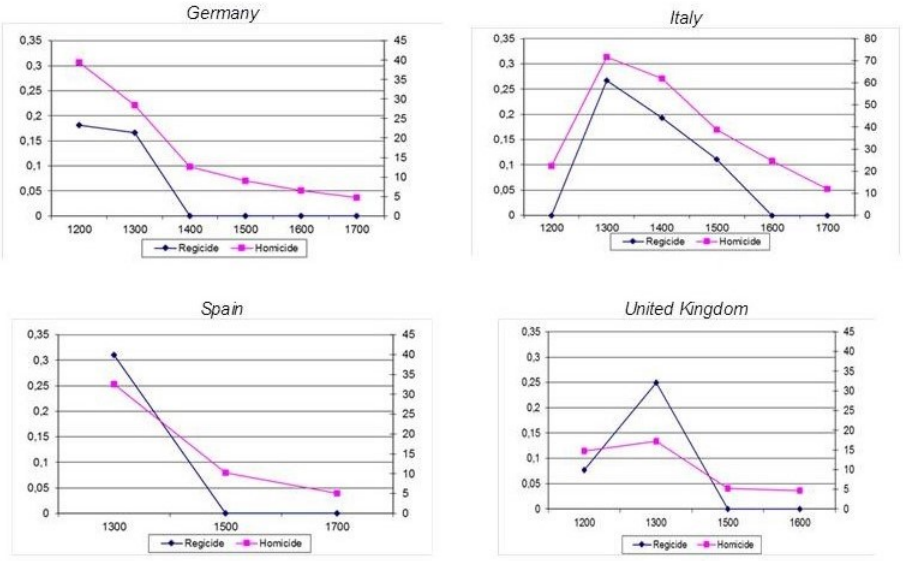
2.2. Graphic Evidence and Timeline Summary

With the theoretical guidance of evolutionary psychology and rational choice theory in mind, we compare a range of interpersonal violence indicators to regicide in order to assess Eisner's (2011) hypothesis that regicide can act as a suitable proxy for interpersonal violence and thereby allow for much earlier research into violence than has been possible previously.

Figure 1, below, compares our estimates of regicide with homicide records in Germany, Italy, Spain and the United Kingdom from Baten et al. (2014). The two series do seem to share a close relationship across these regions, indicating particularly high rates of interpersonal violence between the 13th and 14th centuries before gradually declining toward modern levels. This early result is in line with Elias's (1939) 'civilising process', through which levels of violence steadily decreased toward modern standards as humankind developed outside options to violence when having to solve adaptive problems, perhaps declining as an evolutionary consequence. In Germany, we see strong declines in violence from the 13th century through to the 15th century, followed by a stable development in both series. The relationship is even more appealing in Italy, where there is a strong increase in violence from the 13th to the 14th century, after which both series decline until the 18th century. Unfortunately, for Spain, the periods for which we have both regicide and homicide data do not overlap very well, only providing evidence for the 14th, 16th and 18th centuries. But again, the general trend and the 'civilising process' appear to hold as both series decline over time. Finally, in the UK the series display a high degree of correlation and the increase in violence during the 13th and 14th centuries is again present. These graphics indicate that the 14th century was a particularly violent period throughout Europe, perhaps as a result of the Great Plague of the mid-14th century and the societal turbulence that followed Russell (1971). A clear pattern can be observed, that the 14th century is the climax point of violence in Italy, Spain and the UK; with Germany reaching its maximum one century earlier.

Russell (1971) and others hypothesise that Europe experienced immense population growth during the High Middle Ages and that this increase potentially led to violence due to the probable goods and food shortages that would have been associated with a rapidly increasing medieval population, as well as inefficient distribution networks which would have compounded the effects of these shortages. In times of shortage, populations would have looked to their

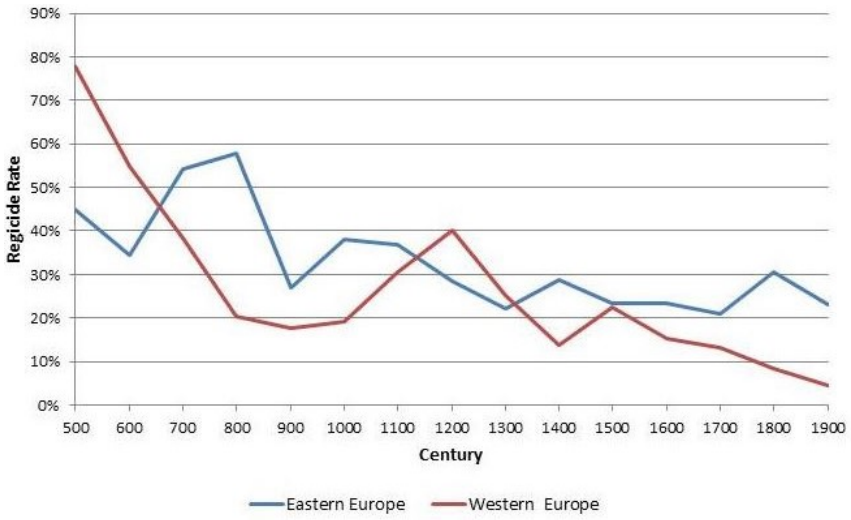
Figure 1: Regional Regicide vs Homicide



rulers for aid; and if none was forthcoming then the likelihood of regicide would have increased during this period, as our figures show. The 'Great Plague' decimated Europe's population in the latter part of the 14$^{\text{th}}$ century (McEvedy et al., 1978), but subsequent conflicts over land ownership meant that reduced population densities may explain why regicide rates do not appear to have decreased at this time. Additionally, it is likely that trade was inhibited at this time for fear of interacting with infected individuals and contracting the plague oneself. Declines in trade volumes would have created food shortages, and would have placed particular pressure on urban centres as they would have relied on imports. Some researchers even speculate that the beginning of the 'Little Ice Age' and the negative effects that it had on food production and trade may have reduced consumption levels to the point where the immune systems of Europeans would have degraded, making them more susceptible to the 'Great Plague' and compounding the devastation that it brought (Koepke and Baten, 2008). Historical European anecdotes, backed up by reconstructed temperature estimates (Guiot and Corona, 2010), are rife with accounts of failed crops, frozen rivers and thick snow that collected on roadways during winters between about 1300 and 1850, even in regions that experience relatively mild winters today (Koepke and Baten, 2008).

Under these circumstances, Eastern Europe entered into the 'Second Serfdom'. The 'Second Serfdom' was an event through which feudal systems were reintroduced into Eastern Europe, after increased state centralisation had dismantled previous feudal systems in order to better organise labour in the aftermath of the 'Great Plague' (Ogilvie and Edwards, 2000). This period, lasting approximately between the 16th and late 18th centuries – although serfdom in Russia was only abolished in 1861 under Tsar Alexander II – is thought to have been the result of the low agricultural output and high land-labour ratio in Eastern Europe that resulted from the plague. That is, the combination of scarce labour and abundant land resulted in substantially higher wages throughout Europe as a result of heightened labour demand (Acemoglu and Wolitzky, 2011), making it a lucrative decision for Eastern European landlords in the late Middle Ages to coerce migrants from Western Europe with promises of land.

Figure 2: The 'Second Serfdom'

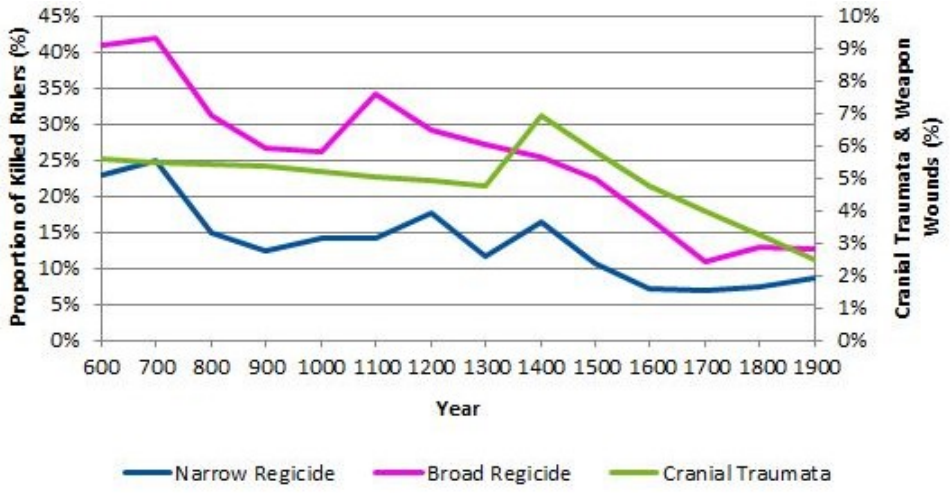


Landlords subsequently grew powerful during the late Middle Ages, due in part to exports to Western Europe (Blum, 1957); amassing militias and bargaining power. Keeping peasants as serfs would have increased inequality (Ogilvie and Edwards, 2000: 961) and potentially led to further interpersonal violence. Graphically, the 'Second Serfdom' does seem to be associated with increased regicide because while the Western European series seems to gradually drop toward the low levels of violence that are present in modern times,

in Eastern Europe they remained stubbornly high as late as the 19th century. Figure 2 clearly shows an increased prevalence for interpersonal violence in Eastern Europe at the time of the 'Second Serfdom', as regicide rates reached between 20% and 30% as opposed to the steady decline towards about 5% experienced in Western Europe during the 19th century.

To our knowledge, regicide itself has been used in one other paper since Eisner (2011) put forth his idea. Baten and Steckel (2017) use it to compare assess another potential indicator of interpersonal violence, the prevalence of cranial traumata and weapon wounds from skeletal remains. They compare the series throughout Europe over the last 2000 years. As in Baten and Steckel (2017), comparing the cranial traumata series to our measurements of regicide presents another good fit, especially as the series looks to be closely related to the narrow measure of regicide (explained below) despite it not presenting a small peak in the 12th century.

Figure 3: Regicide and Cranial Traumata



After drawing from the evolutionary psychology and rational choice literature – and by conducting our own graphical analysis – it is clear that homicide and regicide are closely related from both theoretical and empirical contexts. This relationship allows us to proceed with our analysis by using regicide as a proxy for interpersonal violence. We therefore assess elite human capital, temperature and urbanisation as potential determinants of interpersonal violence.

3. Data

3.1. Regicide Data

We based our data on Eisner's (2011) dataset and then expanded it using a variety of other sources; namely, Morby (1898) and Bosworth (1996), resulting in a dataset spanning 500-1900CE, covering nearly all countries under a broad definition of Europe. When conflicts between the sources arise, we include all rulers that are mentioned across any of the sources, label any conflicting reports of death as 'dubious', and use the dates that allow for continuity between reigns, when possible, or else those from Eisner (2011).

As Europe and Asia form one contiguous land mass, the centuries long debate over the continental border has been political in nature. Therefore, we expand the classical definition of Europe and include Turkey, Georgia, Armenia and Russia in our sample. Turkey was included because of the influence that the Ottomans had on Europe between the 14$^{\text{th}}$ and early 20$^{\text{th}}$ centuries. While all of Russia's monarchs that we have include in our dataset ruled well within Russia's European territories under Europe's classical definition. Armenia is incorporated because of the Indo-European roots of its language and the prevalence of Christianity from the 1st century AD, which became the official religion of the state in about 302 AD under Tiridates III (Parry, 2010: 23). Greater Armenia also stretched into the Kingdom of Cilicia (now southern Turkey) and into the modern Russian Caucasus. Georgia was also included because of its historical prevalence of Christianity (Parry, 2010: 137) and because of the strong self-determination of Georgians to be classified as Europeans – as seen in surveys that have been conducted since the collapse of the Soviet Union (Gogolashvili, 2009: 91).

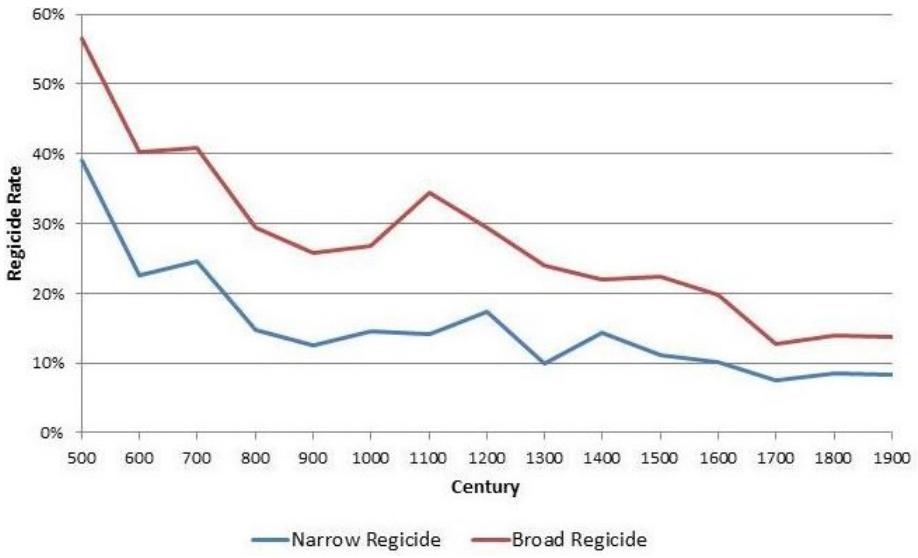
The reasons for choosing our timeline are more straightforward, we wished to make use of as large a period as possible without skewing our results. Consequently, we begin our analysis in 500 in order to eliminate the effect of the Roman Empire and end in the year 1900, before the two World Wars. We deem that including the Romans would have had a biasing effect on our results, as the Roman Empire covered the majority of our chosen region and also displayed incredibly high rates of regicide – often over 90%. We then end our analysis in 1900, because the 20$^{\text{th}}$ century saw drastically shifting borders as European kingdoms tended to transition either into democracies

or dictatorships. Including this period would have resulted in far fewer cross-sectional observations.

Using these regional and chronographic delimiters, we assembled our dataset by accumulating general information such as dates of birth and death, reign dates and the causes of death for 3923 rulers from across 31 European countries. Conquest meant that the borders of kingdoms were continually shifting over this period. Therefore, in order to use modern countries as our cross-sectional units of observation, we assigned kingdoms to countries based on the location of their historical capitals. For example, though the Ottoman Empire stretched into many of the Balkan states, we assigned them to Turkey as their seat of power was based in Constantinople.

As we have alluded to but not yet discussed, our regicide indicator consists of two definitions, narrow and broad. The narrow definition is made up of cases where the ruler was clearly assassinated, such as King Canute IV of Denmark who was killed by rebels opposed to his tax policies after fleeing and hiding in a church in Odense. Narrowly defined, we have 456 cases of regicide, or just under 12% of all rulers.

Figure 4: Defining Regicide



Our broad definition consists, not only of these clear assassinations, but also of deaths in battle or those described as dubious. We have documented 829

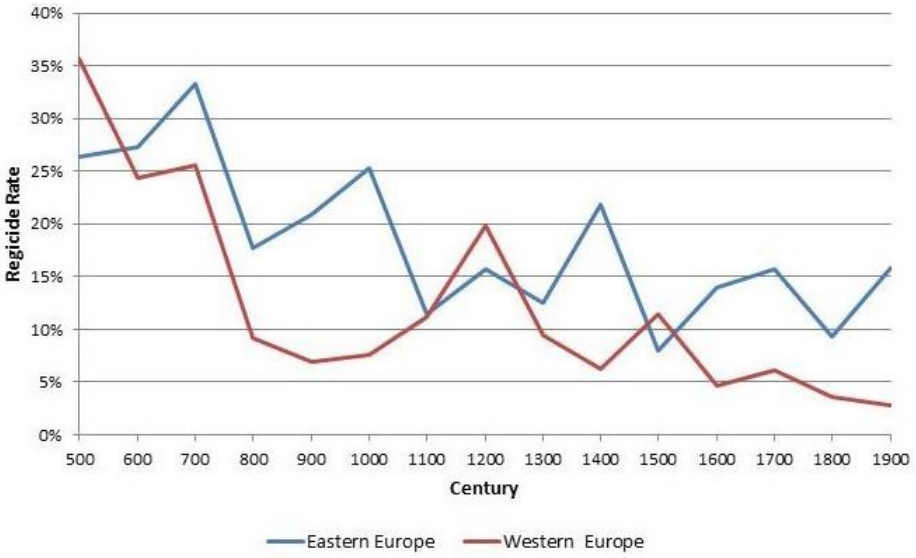
cases of broad regicide, making up 21% of all rulers. We wish to treat dubious and battle deaths somewhat differently from clear assassinations as they may not always reflect interpersonal violence. If the ruler died in a civil war or a war against another ruler within the same country, we argue that such internal conflicts could still proxy the level of violence within the country we are interested. Battles with foreign rulers, however, may simply be as a result of the whim of the foreign power and will therefore be controlled by a variable which measures the number of battles with foreign powers per country and century [2]. Internal conflicts, however, account for most of the battle deaths that we document, though the overall rate of death in battle is surprisingly low when compared to ordinary regicide, making up just 17% as opposed to 65% for clear regicides. Likewise, we label cases as dubious when our sources contradict each other, when there is much suspicion surrounding the death of a ruler – which was common if the ruler was imprisoned at the time of their death, for example – or when a ruler was poisoned – as unsophisticated autopsies would have been unable to trace poisons during most of our timeline. In this way, an overestimation of regicide's causes can be negated to some extent; especially as dubious deaths make up the last 18% of our broad regicide indicator. As shown in *figure 4*, the broad and narrow definitions very closely approximate one another, perhaps with small exceptions during the 11^{th} and 13^{th} centuries.

As a result, we run the main regressions both with and without these dubious and battle-related deaths in order to obtain a more nuanced idea of the relationships between our regicide indicators and their potential determinants. Additionally, keeping the battle series separate allows for a certain degree of inference regarding political or economic pressures that stem from outside a ruler's realm. Throughout the text, we will refer to 'narrow regicide' as 'ordinary assassination' and 'broad regicide' as an expanded definition which includes these dubious and battle death indicators.

Eisner (2011) uses the number of assassinations per 100 000 ruler years as his indicator of regicide, which provides his indicator with more variation – a potentially helpful approach as the number of cross-sectional units of regicide (the number of kingdoms) are relatively low by nature. However, we prefer our twin regicide indicators to his as lifespans increased dramatically over

[2]Note: This hypothesis has not yet been tested.

Figure 5: Narrow Regicide



the period 500-1900AD, meaning that the average duration of a ruler's reign would have increased too. In this way, Eisner (2011) may have exaggerated Elias' (1939) 'civilising process'. In our analysis, such an approach could overstate the effect that factors such as human capital, temperature and urbanisation have on alleviating interpersonal violence – being non-stationary series that increase over time.

3.2. Independent Variables

We propose that certain economic, environmental and social factors determine interpersonal violence by generating the adaptive problems that are solved through violent psychological reactions as described previously. For example, when resources such as food become scarce, incentives to co-opt the resources of others will rise, increasing the probability of both interpersonal violence and regicide. Consequently, we test elite human capital, income and temperature as potential determinants of violence, controlling for inter and intra-state conflicts as well as state fractionalisation while observing the robustness of a dummy variable for the 'Second Serfdom'.

We first make use of elite human capital in order to suit our elite indicator of violence, and also because obtaining a human capital series for all Eu-

ropean populations since 500AD would be impossible. Our theory follows that of Pinker (2011), who proposed that the increased skills in negotiation that are associated with human capital, could lead to lower levels of violence. Increased human capital in the form of education would have also enabled individuals to target their labour toward more profitable sectors in times of economic downturn, helping them to avoid these problems of scarcity in the first place. Additionally, societies that lack the goods and services that contribute to human capital are more likely to blame their rulers, potentially resulting in regicide. The elite human capital measure was therefore constructed by creating an index based on elite literacy and elite numeracy. Firstly, an index was made from Buringh and Van Zanden's (2009) estimates of the number of monastery manuscripts in each country and century between 500 and 1500 AD, and their estimates of books per household between 1500 and 1900. These kinds of measurements are commonly used to proxy human capital as their prevalence is associated with skills in literacy (Buringh and Van Zanden, 2009; McKitterick, 1989). As we use monastery manuscripts – and because books would initially have been widespread only among European elites – these measures adhere to our intention of measuring elite literacy. We then created our own estimates of elite numeracy by measuring the proportion of known birth years among our rulers on a per country, per century basis; thereby creating an age-heaping type indicator which is commonly used to proxy numeracy (A'Hearn et al., 2009; Zelnik, 1961; Myers, 1954). Lastly, we combined these elite literacy and numeracy indices in a one-to-one ratio to form our elite human capital indicator. All measurements were standardised before the indices were spliced together.

Our second potential determinant of interpersonal violence is urbanisation. Throughout the economic history literature, urbanisation rates are considered the most reliable proxy of income for which data is available among early societies (Bosker et al., 2013; De Long and Shleifer, 1993; Acemoglu et al., 2005; Nunn and Qian, 2011; Cantoni, 2015; Cantoni and Yuchtman, 2014). Like human capital, we expect increased income to have a negative effect on interpersonal violence as outside options to violent conduct arise. Wealthier individuals and societies will have faced lower problems of scarcity and therefore experience less incentive to act violently or to commit regicide. Additionally, in their study of violence indicated by cranial traumata and weapon wounds, Baten and Steckel (2017) found evidence for Elias' (1939) long run result that rates of interpersonal violence first declined in

urban centres, lending support for the hypothesis that income is negatively associated with violence, provided that the income-urbanisation relationship holds. Bosker et al. (2013) theorise that one of the reasons for this classic urbanisation-income relationship is due to agricultural productivity. This hypothesis suggests that productive agricultural sectors are required in order to support large urban centres, as these are unable to produce their own agricultural products, particularly in the absence of todays efficient trading systems and without technologies such as refrigeration. Throughout our timeline, agriculture would have contributed to a very large share of each economy, as this feature was typical among early economies and only began to change with the industrial revolution; after which sectors such as manufacturing began to grow disproportionately. However, most of Europe only began to industrialise after its inception in late 18^{th} century England, meaning that this income-urbanisation relationship should have held throughout our period of study.

However, over the 20^{th} century many studies found that levels of violence were higher in urban centres, citing a loss of personal networks and societal support structures that are associated with living in rural villages as the chief reasons. This lack of communal support may have put pressure on resources, thereby increasing both theft and violence. Additionally, the impersonal structure of cities may have reduced disincentives to co-opt resources from others, and diminished any sense of community security that may have existed in rural villages, also potentially leading to violence. Through our analysis, we will gain some insight into which effect is dominant among early societies.

We constructed our urbanisation variable using Bosker et al.'s (2013) estimates of urban populations – urban centres defined as cities with a population of at least 5000 inhabitants – and formed urbanisation rates using McEvedy et al.'s (1978) measurements of country populations by century. As Bosker et al.'s (2013) urban population estimates end in 1800, these were then augmented with urbanisation rates from the *Clio Infra* database for the 19^{th} century. However, in order to penalise the series for urban centres that had less than 5000 inhabitants and to provide a smoother urbanisation series, we instead used the urbanisation rates for 1850 and applied them to 1900.

We also make use of temperature series in order to proxy for agricultural output, particularly in the context of the 'Little Ice Age'. The 'Little Ice Age' has come to be known as a period of general cooling throughout the North-

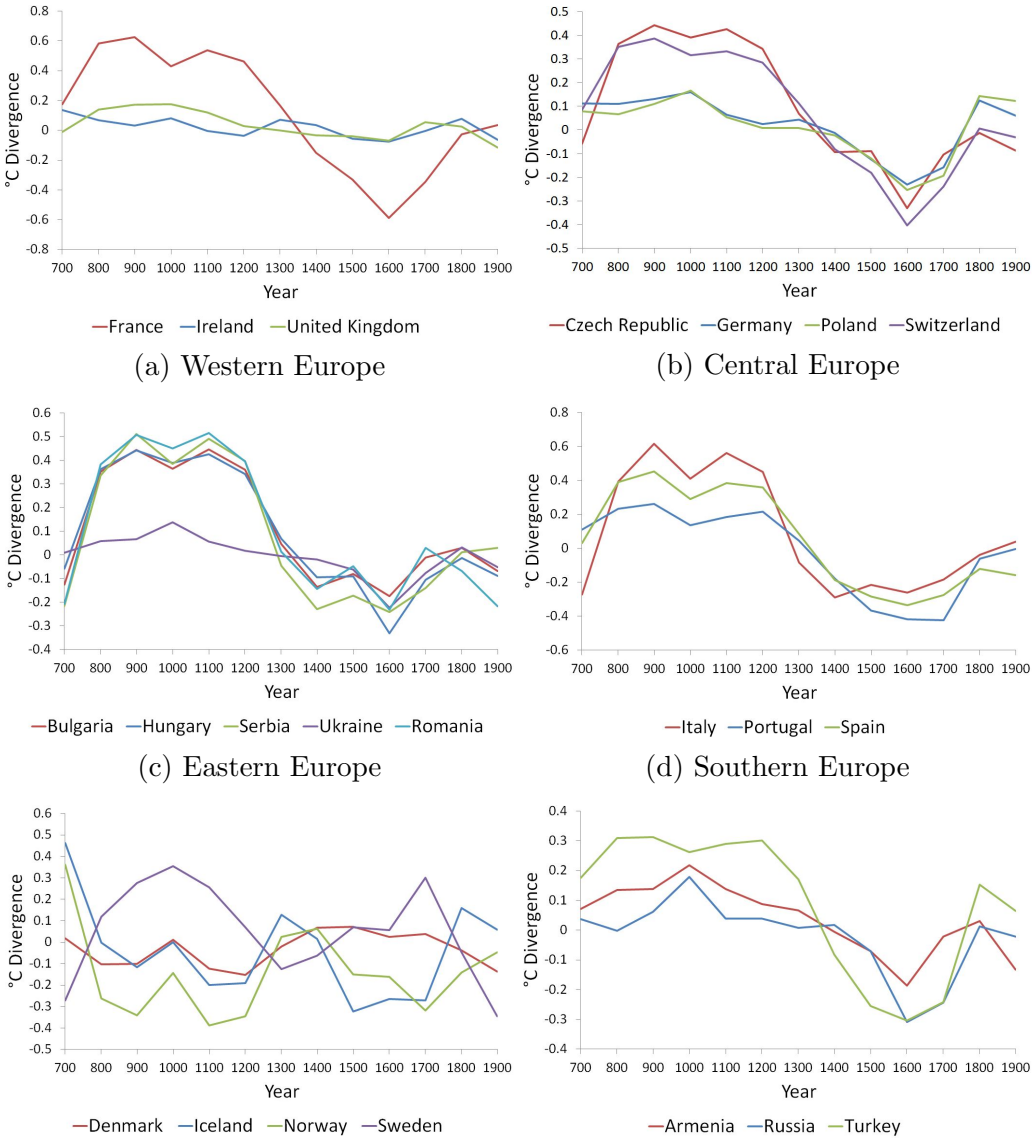
ern Hemisphere and particularly in Europe between about the 16th and mid 19th centuries (Mann, 2002a). Alternatively, it refers to the period between what is known as the 'Medieval Climatic Optimum' – a relatively warmer period from about 900-1300AD – and the warmer modern period that begun around the time of the industrial revolution (Mann, 2002b). The 'Little Ice Age' was characterised by exceedingly cold winters during which rivers were said to have frozen and crop yields were decimated, even in relatively temperate European regions such as the Mediterranean states (Mann, 2002a). The sources for this event have, until fairly recently, been anecdotal in nature (Mann, 2002a). However, more recent studies in historical climatology have provided economic historians with a plethora of long run temperature series from a variety of sources. These include evidence from tree rings, corals, ice core isotopes and pollen assemblages, comparing them to anecdotal evidence when possible (Guiot and Corona, 2010). These sources also tend to be exceptionally consistent across both indicators and regions (Guiot and Corona, 2010).

We use temperature reconstructions from Guiot and Corona (2010), who use all of these indicators to estimate annual summer temperatures for all of Europe in a 5x5 degree grid pattern over the last 1400 years. These are then applied to each country based on the nodes closest to their historical capitals. Temperatures are measured as the deviation in degrees Celsius from the 1961–1990 mean (Guiot and Corona, 2010).

To convert these annual records into centennial estimates – in order to suit the periodicity of our data – we first apply a Hodrick-Prescott filter with a lambda value of 500 000. This extracts the long run trends from each series, removing any noise which is due to the relatively high frequency of the data. Though $\lambda = 500\ 000$ is a much higher value than that recommended by Ravn and Uhlig (2002) for annual data, we argue that a 1400 year series is exceptionally long and that it consequently displays characteristics of higher frequency data, requiring more smoothing than is usual for time series estimates. Finally, we take a simple average of this long run trend for each century.

Figure 6 describes temperature deviations for selected European regions, displaying similar trends throughout Europe. Though the magnitudes of these anomalies differ between countries, all countries except for Denmark and Sweden provide evidence for both the 'Medieval Climatic Optimum' and the

Figure 6: Temperature Deviations for selected European Countries
(°Celsius Deviation from the 1961-1990 Mean)



(a) Western Europe

(b) Central Europe

(c) Eastern Europe

(d) Southern Europe

(e) Scandinavia

(f) European Frontiers

'Little Ice Age'. The modern effect of global warming only appears to be slight in these figures, however, Guiot and Corona (2010) find significant increases in temperatures over the 20th century; falling outside of our period

of interest.

In addition to our three main variables of interest, we also consider certain controls. The first of these is the degree of state fractionalisation. When many kingdoms occupy relatively small pieces of adjacent land, we expect conflict over resources to arise; particularly when these neighbouring kingdoms consist of relatively homogeneous groups which rulers may wish to unite. As these kinds of situations may result in spurious regression between regicide and our variables of interest, we create a dummy variable to control for state fractionalisation when five or more kingdoms simultaneously occupy the region of countries based on today's borders. Information on kingdoms per country is based on the *Geacron* database.

Additionally, though a relatively small proportion of rulers in our sample died in battle, we control for the number of battles with foreign powers per country and century [3]. In this way, we can gain insights into the effect on regicide through civil wars – which we argue is more relevant for interpersonal violence – as opposed to regicide resulting from attempted conquests or defence against invaders. Battle data was obtained from Brecke (1999) as well as the *Clio Infra* database.

Lastly, in order to test whether inequality has had a significant impact on regicide and interpersonal violence, we use the 'Second Serfdom' as a case study. We indicate the 'Second Serfdom' with a dummy variable for Eastern European countries in the 16^{th}, 17^{th} and 18^{th} centuries, and in Russia for the 19^{th} century; as serfdom in Russia was only abolished under Tsar Alexander II in 1861.

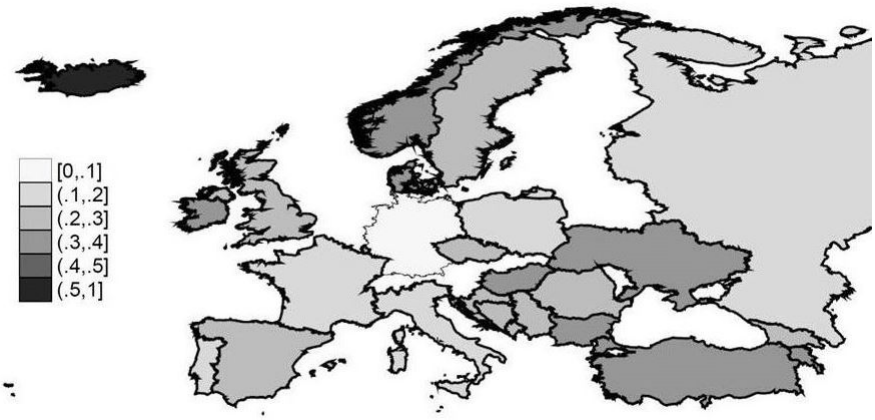
4. Regional Trends in Violence

When considering the distribution of interpersonal violence in Europe, figure 3 implies that the 'Second Serfdom' created a distinct divide between the "peaceful West" and the "antagonistic East". Though this is to some extent true, the patterns in regicide that we identify are somewhat more nuanced. The figures that follow loosely describe the states of broadly defined regicide during the Early Middle Ages, the High Middle Ages, the Late Middle Ages

[3]Note: This hypothesis has not yet been tested.

and the Early Modern Period respectively. Though we relate these general trends to key events within each region – often referring to battles with foreign powers – this does not contradict our hypotheses that environmental and social factors may influence interpersonal violence and regicide. In the same way that droughts or floods may damage crops or otherwise lead to resource shortages, conflicts with foreign powers can both be caused and result in resource scarcity, potentially manifesting itself in regicide motivated by increased desires to co-opt resources. Likewise, these international conflicts may have set up internal political disagreements which could also spur peasant revolts or assassinations. Figure 7 describes the average state of regicide for each country over our entire sample period, showing that Scandinavia was in fact the most violent region over our whole timeline, rather than Eastern Europe.

Figure 7: European Regicide: 500-1900AD

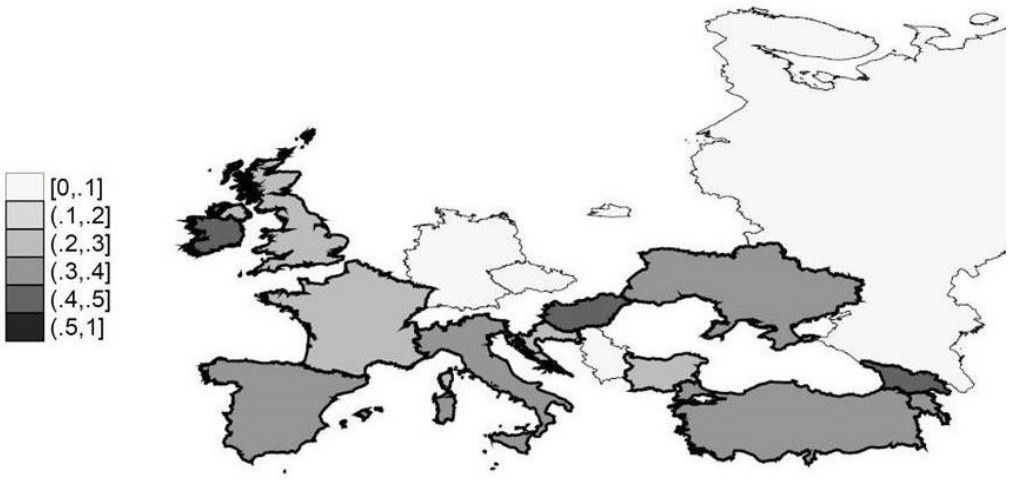


Iceland, Denmark and Norway are – in that order – by far the regions with the highest rates of regicide identified by this study, followed by the Eastern European States of Bulgaria, Hungary, Ukraine, Armenia and Turkey. Scandinavia and Eastern Europe appear far more violent than South Western Europe; with France, Germany, Italy and Portugal appearing to have been particularly peaceful. These are followed by Spain and the United Kingdom which display higher rates of regicide than their neighbours, but fairly low rates when considering the sample as a whole.

During the early Middle Ages (Figure 8) our overall patterns had not yet

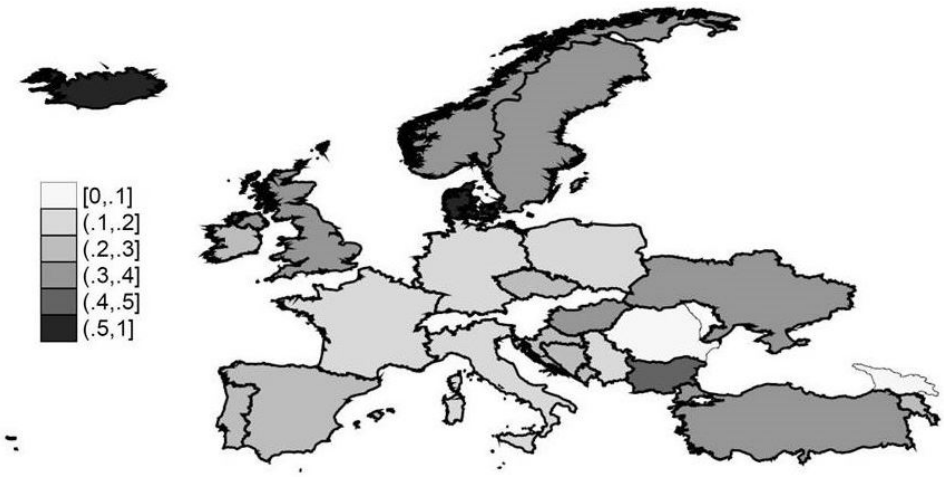
developed; as kingdoms in Ireland, Hungary and Georgia stand out as the most violent, along with the Mediterranean states and Ukraine. During this period, kingdoms within Germany, the Czech Republic and Russia appear to have been the most peaceful.

Figure 8: European Regicide: 500-900AD



Over the next four centuries, Scandinavian violence appears to gain prominence due, at least in part, to the Vikings. Denmark, Norway, Sweden and the United Kingdom all undergo large increases in regicide while the relative intensity of southern and Mediterranean violence from the previous period declines; with the exception of Bulgaria. At this time, the Second Bulgarian Empire was the main power within South-Eastern Europe, though they were under constant pressure due to incessant invasion attempts by the Mongols, Byzantines, Hungarians and Serbs. Meanwhile, their neighbours in Romania experienced one of the lowest rates rates of regicide throughout our entire sample, driven by the Kingdom of Transylvania. Additionally, Georgia transitioned from one of the most violent regions in the Early Middle Ages to one of the most peaceful in the High Middle Ages. Our data coincides with the earlier conflicts that the Iberians had against the Persians and Byzantines, as well as the formation of the first united Georgian monarchy toward the end of the 10^{th} century and the so-called 'Golden Age' which followed. This Golden Age saw Georgia control the entire South Caucasus region before much of it fell to the Mongols from the late 13^{th} century.

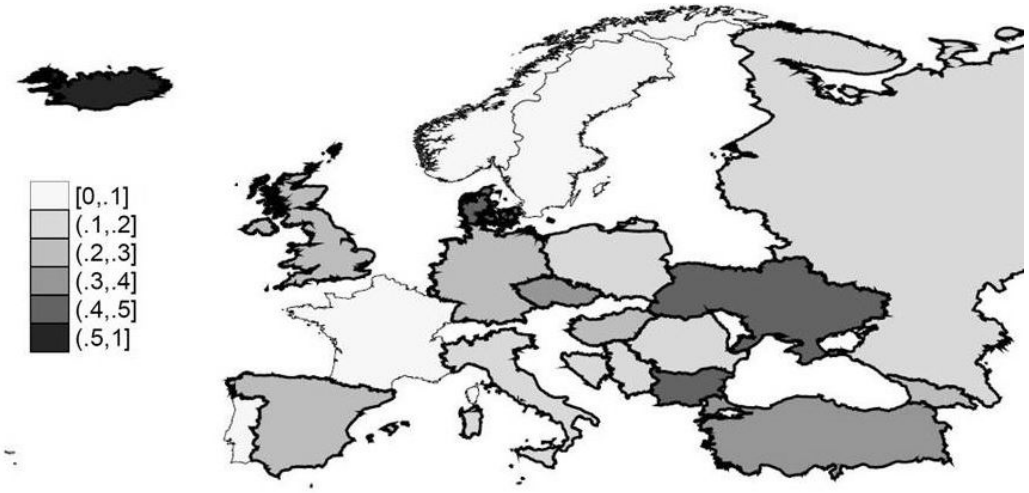
Figure 9: European Regicide: 1000-1300AD



The Late Middle Ages are characterised by near universal trends away from regicide. Though this period begins with the 'Great Plague' – which our previous results do associate with increased regicide – figure 10 seems to be driven by the decline in regicide which followed. Iceland and Denmark still seem to display considerably high rates of regicide, perhaps due to the early struggles in forming their union with the Norwegians and Swedes during the 14^{th} century. Likewise, Bulgaria remains a fairly violent region during the Ottoman expansion while Ukraine was a region of substantial conflict, as the Kingdoms of Poland and Lithuania first fought off the Mongols during the early 14^{th} century before the Ottomans conquered much of Ukraine's Black Sea coastline, as well as Crimea, during the 1470s.

The Early Modern Period (figure 11) then saw drastic declines in regicide, with only the Czech Republic, Serbia and Georgia displaying rates of regicide comparable to those in earlier periods. However, despite these widespread declines in regicide we can still identify a clear east-west divide, as regicide in Norway, Denmark, United Kingdom, Germany, Portugal, Italy and Poland virtually disappears.

Figure 10: European Regicide: 1300-1500AD

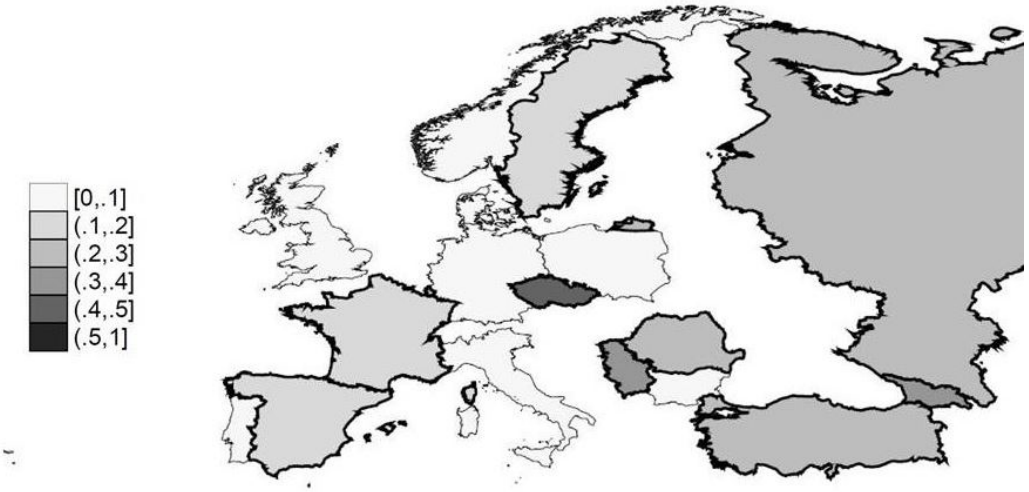


5. Methodology and Results

Having presented our cases for the link between regicide and homicide – as well as those for their common determinants – we estimate the effects that those potential determinants may have had on both the broad and narrow estimates of regicide that we defined earlier. Due to the binary nature of our dependent variables, we use linear probability models (LPMs), including both time and country fixed-effects. Additionally, these models are estimated by means of weighted least squares (WLS) regression, clustered by country.

We make use of a WLS regression, firstly, in order to alleviate the problem of heteroskedasticity. We suspect heteroskedasticity because of the ways in which some of our independent variables should theoretically affect our dependent variable. For example, our temperature series are essentially continuous despite indicating deviations from their respective 1961 to 1990 country averages. However, at zero degrees Celsius crops and rivers to begin to freeze, creating a discontinuity in the relationship between temperature and interpersonal violence via the channel of resource scarcity and the violent resource appropriation that we expect to follow. Heteroskedasticity may therefore bias our standard errors and consequently result in misleading inference. Using WLS solves this problem by re-weighting each observation by the inverse of its variance relative to the Ordinary Least Squares (OLS) regression function.

Figure 11: European Regicide: 1600-1900AD



We also employ cluster-robust standard errors as we do not expect within-country observations to be entirely independent of one another, perhaps due to cultural or geographic differences which may then influence rates of interpersonal violence. When observations are not entirely independent standard errors may be biased downwards, potentially leading to a type 1 error – falsely asserting statistical significance. Essentially, instead of controlling for these factors directly, clustering allows us to account for any within-cluster correlation that omitting these variables may cause by grouping them as country specific characteristics.

Additionally, we make use of the panel structure of our data and employ fixed-effects regressions, allowing us to control for any omitted variable bias that is time-invariant. Again, these may consist of unobserved cultural or geographic variables, for example, that may affect violence and remain constant over time.

Initially, we run our regressions based on our narrow definition of regicide and use a variety of specifications, including time and regional fixed effects. Disappointingly, these results do not reveal any consistent patterns and our regressors only indicate significance sporadically. Regression two yields the only result worth any comment, as both elite human capital and temperature provide significant negative coefficients, indicating that regicide decreases as either elite human capital or temperature increase. Though these results are

in line with the theoretical channels that we've outlined previously, the rarity of significant coefficients throughout these regressions as well as the reliance on not including regional fixed-effects in regression 2 makes us hesitant to interpret these results further.

Figure 12: Narrow Regicide Regression Results

Regressors	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Elite human capital	-0.0292	**-0.0270*** **	-0.0238		-0.0262	0.00921	**-0.0525*** **	
	(0.0210)	(0.00551)	(0.0165)		(0.0228)	(0.0143)	(0.0151)	
Temperature	-0.0428	**-0.1560***	-0.0952	-0.1050	-0.0331	-0.1090	-0.0650	-0.1120
	(0.0571)	(0.0833)	(0.0717)	(0.0993)	(0.0599)	(0.0717)	(0.0433)	(0.1010)
Urbanisation	-0.3760	0.3390		**-0.5020****	-0.4350			**-0.5090****
	(0.3160)	(0.5280)		(0.241)	(0.3060)			(0.2340)
Fractionalisation					0.0222	**-0.0733***	-0.0449	-0.0224
					(0.0448)	(0.0358)	(0.0381)	(0.0307)
Second Serfdom					0.0404	**0.1420****	0.0259	**0.0760***
					(0.0404)	(0.0505)	(0.0437)	(0.0427)
Time FE	NO	YES	YES	YES	NO	YES	NO	YES
Region FE	YES	NO	YES	YES	YES	YES	YES	YES
Constant	0.0637**	0.3200***	0.2410**	0.2280*	0.0564**	0.2590***	0.1230***	0.2430**
	(0.0213)	(0.0161)	(0.1020)	(0.1120)	(0.0242)	(0.0787)	(0.0357)	(0.1090)
Observations	60	60	72	102	60	72	72	102
R-squared	0.246	0.358	0.398	0.264	0.264	0.488	0.253	0.283
Robust standard errors in parentheses								
*** p<0.01, ** p<0.05, * p<0.1								

However, once we employ the broad definition of regicide (Figure 13), our results improve drastically. Elite human capital, temperature and urbanisation all consistently enter into the regressions with significant negative coefficients. Across specifications, the coefficients for elite human capital seem to remain fairly stable at around -0.05. Since elite human capital is a standardised variable, a one standard deviation increase in our elite human index is associated with a 20^{th} of a standard deviation decrease in regicide. Through this stable negative relationship, the hypotheses that education provides outside options to violent conduct through the negotiation or by solving scarcity problems by starting a new job are considered plausible.

Likewise, the coefficient for temperature consistently remains at around -0.15, meaning that a one degree increase in the average annual summer temperature, relative to the 1961–1990 average, is associated with a 15 percentage

point decrease in regicide. Since the standard deviation of our temperature series is 0.23 degrees, a typical deviation increase in temperature is associated with around a 3.5 percentage point decrease in the regicide rate. In the European context, where most countries experience relatively harsh winters – with the possible exceptions around the Mediterranean – warmer average temperatures will usually have equated to better harvests as the absence of frost and ice allows for increased agricultural output. As agricultural production would have contributed the majority share to all economies over our timeline this consistently negative temperature effect suggests that resource abundance leads to lower regicide and interpersonal violence, as one would expect.

Figure 13: Broad Regicide Regression Results

Regressors	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Elite human capital	**-0.0521*****	**-0.0582****	**-0.0449***		**-0.0497*****	-0.00591	**-0.0904*****	
	(0.0181)	(0.0233)	(0.0231)		(0.0184)	(0.0244)	(0.0184)	
Temperature	-0.032	**-0.1800***	**-0.1480***	**-0.1580***	-0.0256	**-0.1610***	-0.0609	**-0.1690***
	(0.0738)	(0.107)	(0.0832)	(0.0839)	(0.0755)	(0.0838)	(0.0825)	(0.0895)
Urbanisation	-0.7390	0.6680		**-0.7910***	**-0.7830***			**-0.7710****
	(0.5060)	(0.6700)		(0.411)	(0.047)			(0.336)
Fractionalisation					0.0321	-0.0738	-0.0339	-0.0323
					(0.0431)	(0.0470)	(0.0459)	(0.0340)
Second Serfdom					0.0368	**0.1830*****	0.0157	**0.1220****
					(0.0587)	(0.0671)	(0.0602)	(0.0519)
Time FE	NO	YES	YES	YES	NO	YES	NO	YES
Region FE	YES	NO	YES	YES	YES	YES	YES	YES
Constant	0.157***	0.324***	0.339***	0.206***	0.149***	0.360***	0.222***	0.231***
	-0.0488	-0.0293	-0.0722	-0.071	(0.0533)	(0.0583)	(0.0385)	(0.0665)
Observations	60	60	73	100	60	72	72	102
R-squared	0.359	0.369	0.514	0.349	0.370	0.580	0.373	0.383
Robust standard errors in parentheses								
*** p<0.01, ** p<0.05, * p<0.1								

The effect of urbanisation is also fairly consistent, when significant, and provides a coefficient of around -0.8. The standard error of our urbanisation variable is 0.03 percentage points, meaning that a typical deviation increase in the level of urbanisation is associated with a 2.3 percentage point decrease in regicide. Again, this result is similar to those of human capital and temperature. As urbanisation has been used throughout the economic history literature to proxy both income and agricultural productivity – as opposed to

agricultural output which we consider to have been captured by temperature – greater income and productivity levels are associated with lower rates of regicide and interpersonal violence. Regressions four and eight, which include both time and country fixed-effects, indicate some degree of multicollinearity between urbanisation and elite human capital, as these coefficients enter significantly as soon as elite human capital is omitted. As one would expect human capital to be related to both income and agricultural productivity – the latter potentially increased through technological inputs such as farming equipment – this motivates our use of elite human capital and urbanisation as proxies for education, income and productivity respectively. Though methods such as partial least squares and principle component analysis can help to aid inference in the presence of multicollinearity by extracting more precise coefficients and standard errors, we leave such analyses to future research.

We also control for the level of state fragmentation by employing our fractionalisation dummy. However, it presents no significant coefficients, implying that the prevalence of inter-state conflicts may not have led to regicide independently of channels such as causing resource scarcity, the effect of which would have been captured by our temperature variable.

Lastly, as indicated by our country graphs, the 'Second Serfdom' does appear to have significantly affected the rate of regicide, but only when time fixed-effects are used. Regressions six and eight indicate regicide premiums of 18.3 and 12.2 percentage points in the presence of the 'Second Serfdom' respectively (Figure 13). There may also be some degree of multicollinearity between our 'Second Serfdom' dummy variable and elite human capital, perhaps indicating that educational inequality and factors such as static social stratification may have been the reasons for increased regicide and interpersonal violence in Eastern Europe during the early modern period, rather than inequality in income.

The output that we obtain from our broad definition of regicide appears to present more significant results and to better match our hypotheses. As seen in figure 4, the broad definition of regicide also provides a smoother time series, probably as a result of its much larger sample size. Consequently, we find these results to be more convincing than those for narrow regicide. Additionally, as the broader definition better fits our hypotheses, we tentatively suggest that both dubious regicide and regicide through battle deaths are also relevant in proxying interpersonal violence.

6. Conclusion

This paper expands on the seminal work of Eisner (2011), who identified a strong relationship between European homicide and regicide between 600 and 1800AD. Through theoretical discussion and empirical application, this paper lends support to his results. This is initially garnered by linking both interpersonal violence and regicide to the hypothesis that violence is a rational and evolutionary response to adaptive problems that human beings have faced throughout our evolutionary development. We then find evidence for these theoretical outcomes by comparing homicide and the prevalence of cranial traumata to regicide, again finding close relationships both regionally and throughout Europe as a whole; identifying Elias' (1939) 'civilising process' in the process.

Levels of violence appear to have been similar in both Eastern Europe and Western Europe throughout the high middle ages – and even higher in Western Europe during the early middle ages – after which a clear divergence takes place until regicide in Western Europe all but disappears by the end of the 19^{th} century while remaining stable in Eastern Europe.

Our empirical results then indicate that our broad indicator of regicide acts as a better proxy for interpersonal violence; either as a result of a much larger sample, or because regicide that we've termed dubious or as a result of battle is also relevant for interpersonal violence. Through this broad indicator, we find consistently negative conditional correlations between elite human capital and regicide, perhaps through Pinker's (2011) negotiation channel for conflict resolution or through any alternative income opportunities that may have alleviated resource scarcity among individuals. We also find that temperature has a stable negative relationship with regicide, indicating – in the context of Europe's relatively cold winters where many harvests may have failed, particularly during the 'Little Ice Age' – that resource abundance reduced the likelihood of regicide by alleviating resource scarcity. The degree of urbanisation also appears to have reduced the rate of regicide, with its relationship to income and security appearing to have eclipsed any competitive or criminal effect that may have taken place within cities throughout our timeline (Bosker et al., 2013). Additionally, we detect a strong association between Eastern European violence and the era of the 'Second Serfdom', implying that inequality – and particularly inequality in education – may

have led to interpersonal violence and regicide. Our regressions do not, however, confirm causality; as our fixed-effects estimations cannot eliminate any reverse causality that may exist. However, we find our conditional correlations to be plausible and constructive nonetheless, and we are confident that causality exists in the negative associations that we find between temperature and regicide, as climate is considered exogenous by nature.

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