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ORIGINAL ARTICLE

Historical state stability and economic development in Europe

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Abstract

In this paper, we show that state stability exhibits a persistent and robust non-monotonic relationship with economic development. Based on observations in Europe spanning from 1 to 2000 AD, regions that have historically experienced either short- or long-duration state rule on average lag behind in their local wealth today, while those that have experienced medium-duration state rule fare better. These findings support the argument that both an absence as well as an excess of state stability are bad for economic development. State instability hinders investment for growth, while too much stability is likely indicative of elite capture and subsequent stagnation of innovation.

Keywords: Development; economic output; sovereign turnovers

1. Introduction

How are state presence and turnovers related to economic development? While state presence is conducive to investment and growth, its longevity can also cause rent-seeking interests to accrue over time and lead to economic stagnation. Frequent state turnovers may induce instability to hinder development, but some may be beneficial when they replace entrenched and dysfunctional states (Olson, 1982, 1993). In this paper, we attempt to adjudicate between these opposing perspectives by constructing suitable measures of state presence over space and time. We discuss various issues involved in this endeavor and present our results that focus on Europe from 1 to 2000 AD. Over this time period, we calculate the mean duration of state rule for identically sized grid-cells that cover the continent. While the relationship between state variables and economic development can be studied in detail for any given region or a period, a large-N case study over extended time periods can help us to understand the general pattern of such changes. We pursue our inquiry using data from Europe, the region with a large body of existing literature. The rise of the West, in particular, has been attributed to many different factors, and we test these competing explanations to examine whether our measure of state duration remains closely related to income levels after controlling for them. To our knowledge, this is the first such attempt at a systematic empirical analysis on the relationship between state duration, turnovers and development.[1]

Estimating sovereign state presence and changes over time faces several challenges. First, because these state borders have not remained constant over the centuries, it is inappropriate to view them as they are today. Many sovereign states ceased to exist, while others were founded

[1]The topic of state changes and economic development in more contemporary time periods however has been studied extensively. See for example Alesina *et al.* (1996)'s work on political instability and Durham (1999) on regime types and economic growth using more recent panel data.

in their places with different borders. In order to minimize this issue and expand the number of observations in Europe, we construct identically sized grid-cells for our analysis. This is done by first creating a rectangle covering Europe and the surrounding bodies of water, and dividing it into smaller grid-cells. Next, we identify the number of centuries of state presence (out of 20 centuries in total), as well as the number of unique sovereign states that ruled over each grid-cell from 1 up to 2000 AD in century intervals (from 1 to a maximum of 21). Based on the total number of different sovereign states that ruled over the area and the length of state presence, we then derive the mean duration of state rule. For our outcome variable, we also calculate the natural logarithm of 2010 GDP per capita for each grid-cell (a more detailed description of this approach is discussed in the following sections). Our state variable is intended to capture both the variation in different states' rule and the length of state presence. The unit of our observation makes it possible to observe the turnovers in state rule and presence at the local level, and to move beyond the context of ruler changes under fixed regimes and geographical borders.

With the construction of these variables, we find a non-linear relationship between the mean duration of state rule calculated over the two millennia and the current local income level in Europe. Regions at both ends of the spectrum show lower incomes relative to the ones in the middle range. That is, we find an inverse U-shaped relationship between the mean duration of state rule and their income levels today. The mean duration of state rule is weighted by the number of unique states present in the grid-cell, such that other factors held equal, a higher number of states decreases the measure. It is also conditional on the number of centuries of state presence, which tells us the extent to which the region was under the rule of any state. We find that regions with either short or extremely long mean duration of state rule, conditional on state presence, fall behind those that had experienced rule by states with relatively modest duration.

In order to address potential problems arising from omitted factors influencing both the mean duration of state rule and the economy, we introduce the following set of controls. First, we include geographic variables such as elevation and agricultural suitability, as well as the distance to water and agricultural adoption date. These variables collectively measure the level of natural resources that certain regions were endowed with, and the timing of agricultural transition, in particular, explains the timing of state formation prior to 1 AD (Borcan *et al.*, 2018). Here we posit that natural resources historically influenced state turnovers through predation and innovation, while also directly affecting income levels today. Second, we include the region's distance to the nearest prominent cities, in order to control for those that played central roles in historical development as well as the economy today. We include grid coordinates (longitude, latitude, and their product), as one may argue that certain locations likely experienced more turnovers than others. We also include modern country fixed effects (based on the year 2000), to control for any time-constant unobservables that vary across current state borders.

In addition, we present a set of robustness checks on the main results in the Appendix. First, we test whether the significance of the mean state duration coefficient estimate remains robust to the inclusion of the state presence variable as a separate control, which has been discussed as a main driver for long-term growth (Bockstette *et al.*, 2002; Borcan *et al.*, 2018). We also control for the presence of historically important empires in our main results, and include various regional dummies and existence of capital cities across different specifications. We find that the non-linear relationship remains strong, independent of the length of time a region has been under state rule. Next, we control for local institutions, as well as conditions under which turnovers took place. Different types of local institutions likely influenced the extent of the sovereign states's rule over them, and determined the long-term outcomes of the region in each grid-cell. Furthermore, changes in rule may have occurred violently with destruction of capital, which likely had differential consequences compared to less traumatic transitions. Using Bosker *et al.* (2013) and Dincecco and Onorato (2017)'s data, we look at whether there existed an active parliament in a city for each grid cell, as well as whether there was any physical plunder, siege or battle. Including these additional controls does not alter our main findings. In order to check whether our results are robust to measurement errors, we then show additional findings under different measures of mean duration of state rule and GDP per capita. These include calculating the mean state duration using the number of state turnovers (rather than the number of unique states), and period discount rate. Finally, we present models adjusting for any potential spatial autocorrelation and find that our results remain robust.

Before conclusion, we also discuss how our analysis may be potentially sensitive to the length and the choice of time period. We present findings from running the analysis across different cutoff periods. For example, looking beyond the most recent five centuries of nation-building and conceptualization of modern Weberian statehood, we find that the inverse U-shaped curve emerges and remains consistent throughout longer time periods going back to 1 AD.

The rest of this paper proceeds as follows. In Section 2, we discuss the importance of state stability in economic development in the literature. We present our data sources, construction of our main variable, the mean duration of state rule, and other control variables in Section 3. We list the estimation equation in Section 4, and in Section 5 show the main findings of the paper where we present evidence of the negative and nonlinear relationship. In Section 6, we discuss the results from different time spans, and conclude in Section 7 with a discussion on related topics for future research.

2. State instability and economic development

Within the vast literature on state and development, Olson (1982, 1986, 1993) provides guiding theoretical insights to help explain the rise and decline of economic development due to state duration. Specifically, the idea of roving versus stationary bandits (Olson, 1993) describes the incentive structures for state subjects. In the case of roving bandits which occasionally plunder subjects, states are constantly changing, which in turn provide little incentives for the subjects to invest and produce. Short state duration thus corresponds to instability and low levels of economic development.[2]

States of stable order, on the other hand, are achievable when roving bandits turn into stationary bandits and take the form of taxation rather than plunder. The stationary bandits solve the inherent collective action problem in societies looking to transition from anarchies to stable states.[3] Furthermore, they provide social contracts and protection for their subjects, to the extent that their incomes are maximized by increasing the investment and production by the subjects. But long state duration may also face reduced productivity with the eventual rise of powerful interest groups over time (Olson, 1982, 1986). These groups benefit from furthering their own agendas and private gains at the expense of outcome for society as whole, and may lead to the process of "institutional sclerosis, slowing its adaptation to changing circumstances and technologies" (Olson, 1982).[4]

The insights from Olson's works have been supported by others in the literature. For example Cox *et al.* (2015) show that in the presence of frequent conflicts, rulers have little incentive to

[2]Blaydes and Chaney (2013) find for example that short mean ruler durations are correlated with the likelihood of rulers being deposed. Similarly, we look at the mean state duration and interpret it as a measure of state stability in this paper.

[3]The benefits of state presence compared to anarchy are well known. Rules under state can improve cooperation among different economic units by improving information flow, resolving collective action problems, lowering transaction costs, sanctioning members and improving state capacity in general (Jones, 1988; Knack and Keefer, 1995; Fearon and Laitin, 1996; Besley and Persson, 2009). These improvements offer the necessary conditions for subjects to engage in productive activities and subsequent economic development. While there have been numerous non-rule-of-law states historically, Hoff and Stiglitz (2008) explains the phenomenon as a result of coordination failure where a commitment to forgive thefts is not credible, thereby hindering transition.

[4]Stasavage (2014) similarly presents a set of arguments on the stagnating effect of long-run survival of city states in Europe. While similar in the emerging empirical pattern, our paper focuses on both the effect of multiple turnovers and state presence, rather than the duration of autonomy, on economic development.

invest in state-building and strong states fail to emerge, while Alesina and Perotti (1996); Barro (1996) make the now well-established claim that political instability is harmful to development. Numerous works also discuss cases in which long and stable states perform poorly as they become resistant to beneficial changes. Lagerlof (2016) presents an institutional mechanism in which autocracies invest in extractive capacity and become more resistant to democracy, while Hariri (2012) presents similar arguments in the case of former colonies. The longer a state persists in a society, the more a particular group of economic actors become beholden to that institution. As in Olson (1982, 1986), such special interest groups contribute to institutional stagnation that could, in turn, result in lowering economic growth over time (North, 1971; Horgos and Zimmermann, 2009; Coates *et al.*, 2010, 2011).

In the case of stagnant states, institutional modifications can impact local economic development through increases in state capacity, wealth and redistribution, even when such changes are violent and destructive (Tilly, 1992; Stasavage and Scheve, 2012; Dincecco and Katz, 2016). Given that state overthrows by subjects are difficult due to collective action problems, rulers are often replaced by succession crises or external invasions (Olson, 1993). These "creative destructions" may lead to strong states in regions with no prior state foundation, or new ones replacing the old and inefficient, varying by natural surroundings and exogenous shocks (Acemoglu *et al.*, 2005, 2011). However, these findings are not usually based on multitudes of state turnovers. Rather, a period of instability is often followed by establishment of stronger institutions, and the transition is complete after few turnovers.

3. Data sources and description

In constructing our mean duration of state rule variable and other controls, we use two main data sources in this paper: (1) Euratlas, which provides historical maps of Europe, and (2) Eurostat, which provides GDP data for the entire continent.[5] The historical maps from Euratlas contain geographic boundaries of all political entities in Europe for every 100 years starting from the year 1 until 2000 AD. These maps provide us with information on the sovereign entity that ruled a given region in Europe at the turn of the century over the past 2000 years. While the time span that we look at is limited by the absence of similar maps in earlier periods, the existing maps are particularly useful since they allow us to track political changes for a particular region over time. By overlaying these maps on top of each other, we can obtain a list of different sovereign entities that governed a given area.[6] As an example, consider different parts of present-day Germany; many sovereign entities have ruled parts of these areas, and the major ones include Kingdom of Austrasia, Saxony, Bavaria, Kingdom of the East Franks, Kingdom of the Holy Roman Empire, Brandenburg, Bohemia, Prussia, Hanover, the German Empire and the Federal Republic of Germany. Such a listing of sovereign rulers allows us to count the number of centuries for which each region was occupied by a state, but also identify unique sovereign states that occupied these areas.

Figure 1 presents the overlap of the political boundaries in Europe using all of 21 Euratlas maps. Europe provides an apt case study for us, since there were extended periods of fragmentation of former empires but also consolidation of nation states.[7]

In order to identify what we mean by sovereign states, we first require a working definition. Since the study covers 1 to 2000 AD, our definition of "sovereignty" should be one that is consistent over this time period. Admittedly this task is difficult, because the concept of sovereignty

[5]The Euratlas data set is available at http://www.euratlas.com/index.html and the Eurostat data set is available at http://ec.europa.eu/eurostat, both accessed 30 September 2015.

[6]One may also argue that the states preceding 1 AD may not be as relevant, as their state capacity was arguably limited and their influence on the present outcome should be discounted in time; we discuss these matter more in detail below.

[7]According to Euratlas, between 1 and 2000 AD, the number of sovereign states in existence in Europe reaches its peak of 158 by 1300 AD, and then decreases with centuries of state consolidation afterwards.

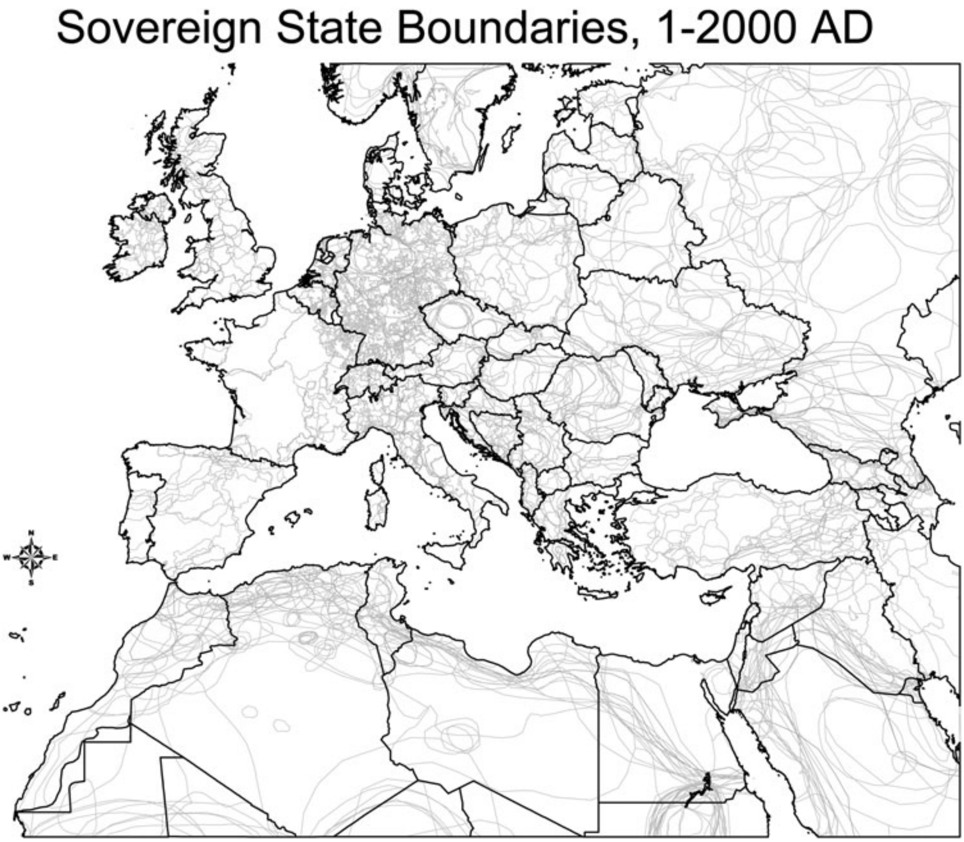

Figure 1. Overlap of Sovereign Rulers (1–2000 AD). The above figure presents the overlapped boundaries of all sovereign rulers in Europe based on Euratlas for the period 1–2000 AD. The boundary in black refers to present-day (year 2000) state boundaries.

likely has changed and there have been both institutional and jurisdictional fragmentation of states in the European history (Brewer, 1989; Epstein, 2000; Drelichman and Voth, 2014). The goal of our paper is not to define a new, encompassing terminology that satisfies all the different definitions of sovereignty over different regions and time periods. That said, it is possible to identify sovereign states in Europe as long as we are consistent in the manner through which we single out such entities. In this paper, we identify a sovereign state as an independent entity that possesses four features as outlined in Euratlas (http://www.euratlas.net/): (1) a territory delimited by borders, (2) a population, (3) an authority exercising the effective public power on population and territory, (4) supremacy, that is with capacity to control absolutely the territory and the population.[8]

Both big empires and small city-states (e.g., the Roman Empire and Venice) are classified as sovereign states in Euratlas, since they satisfy all of the said criteria. On the other hand, Euratlas inevitably excludes some entities that could be described as independent polities but did not satisfy one or more of these criteria. For example, it describes some of the excluded entities as autonomous peoples: generally nomadic, semi-nomadic or not well-known populations without evident central authority. This approach necessarily limits the number of entities in

[8]Further information on the definition of sovereign states is available at http://www.euratlas.net/history/europe/explanation.html, accessed 19 August 2015.

consideration, especially in the early periods. Nevertheless, we only focus on the sovereign states as defined above, because our main interest lies on the effect of changes in both defined territorial borders and central authorities that have become fundamental to the modern states today. There are clear advantages when identifying sovereign states in this manner. First, the definition can be consistently applied over the last 20 centuries. Second, this conception of a sovereign state is different and more general from the other similar terms such as "regimes" that are used primarily to distinguish between democracies and autocracies (Przeworski *et al.*, 2000; Jong-A-Pin and Haan, 2011). Our use of the term "sovereign state" and "sovereign entity" (used interchangeably in this paper) is preferred, because we cover a vast time span (1–2000 AD) where typologies such as democracy and autocracy are less relevant, especially in the early time periods. Lastly, it is consistent with our empirical data source, ensuring that our theoretical conception of a "sovereign state" matches the empirical strategy in this paper.[9]

Given this definition of a sovereign state, a change in sovereignty of a particular region refers primarily to a change in the authority that governs the region and its population (Nussli, 2011). Typically, dynastic changes or ruler turnovers are not considered as state turnovers in the data; we therefore focus predominantly on conquests that involve domination by foreign entities. According to this approach, mergers and turnovers following implosion of a state would also not be considered state turnovers, so long as the region retains a common entity as listed in Nussli (2011)'s references.[10]

Combining state presence and turnovers, we construct our measure of mean duration of state rule as follows:

$$\text{MeanStateDuration}_i = \frac{1}{\#\text{States}_i} \frac{\#\text{Centuries of Rule}_i}{20\text{Centuries}} \tag{1}$$

where subscript i refers to grid-cell i, *#States* refers to the number of unique sovereign states that ruled over the grid-cell from 1 to 2000 AD, and *#Centuries of Rule* refers to the number of centuries (out of a total of 20) for which the grid-cell was under state rule. The above formula gives a composite measure of mean duration of state rule, capturing both the total number of states that ruled over the region, as well as the number of centuries of state presence within the 21 century time frame in our data. One could interpret the measure as a proxy for state stability, similar to Blaydes and Chaney (2013))'s ruler duration.[11] The difference here is that our measure captures the level of instability through state turnovers rather than ruler changes. The measure also incorporates the fraction of time for which region i witnessed the presence of a sovereign state. The importance of state presence and its antiquity are discussed at length in both Bockstette *et al.* (2002) and Borcan *et al.* (2018)'s work, which also present findings that are in line with our empirical findings below. Our approach to understanding the impact of state history differs

[9]Other categories of states, including what some may consider to be semi-independent, are addressed on case-by-case basis. For example, Cologne officially became a free imperial city from 1475 until the French occupation of 1794, and is thus considered a sovereign state in 1500 AD, although the real legal status of the imperial cities was unclear before the 16th century. Venice was an administrative unit of the (Eastern) Roman Empire from its foundation until about 810 AD. Some historians consider Venice as a semi-independent state from about AD 715, which remained semi-independent until 1060–1090 AD over the war between Constantinople and Normans. Euratlas considers the city state to be fully sovereign between 1100 and 1700 AD. Finally, Milan was a city of the Lombard Kingdom and then of the Empire of the Romans (known later as the Holy Roman Empire) until the wars of the Lombard League. After the 13th century, Milan became a sovereign state but sometimes semi-independent until the Spanish conquest in the 15th century. Euratlas codes Milan as a sovereign state in 1300 and 1400 AD.

[10]Although some of these dynastic changes are certainly considered pivotal in the region's subsequent development trajectory (seee.g., Blaydes and Chaney (2013)), our aim for this paper is to systematically identify changes in sovereign states and minimize ambiguities arising from the definition of turnovers. The resulting conservative measure for state changes is a response to the otherwise conceptually unclear classification of many state (vs. dynastic) turnovers observed over centuries.

[11]The authors find that there is an inverse relationship between ruler duration and the probability of being overthrown.

from these authors, in that we use a fixed geographic unit of observation (grid-cell) to count the number of unique sovereign states, and calculate the mean duration of state based on this number. Unlike the existing works, we focus on the outcome of state changes at the *local* level instead of the state level in the current period. The geographical boundaries of these states have changed over time and created regions with different state histories, and are now contained within the same current state.

Our approach follows existing works that have similarly used either century or half-century intervals to track political situations (Bockstette *et al.*, 2002; Stasavage, 2014; Borcan *et al.*, 2018). There is arguably no objective and measurable criterion to define the relative importance of specific years, or correct time intervals for analysis. Euratlas captures state presence at fixed moments in history; ideally we would obtain a map of Europe for every year since there could be cases where state changes took place within a given century. In presenting only the states at the beginning of each century, Euratlas maps potentially leave important information out, but do show the result of every time sequence within the 2000 years. We argue that while events in between centuries are not captured in the Euratlas data, it is also unlikely that state changes took place systematically by the imposed century-intervals, in anticipation of the beginning of a new century. That is, we find no reason to believe that our observations in the beginning of each century would lead to a bias with an outcome different from those observed over some other time intervals. On the other hand, there still remain potential issues with measuring the mean state duration, as we can only track state presence at the beginning of each century. As explained in the following sections, we attempt to address potential systematic measurement issues in certain regions by introducing a set of controls, including standard geographic covariates as well as regional and development indicators.

The other data that we use in this paper are Gross Domestic Product (GDP) and the population in the year 2010 from the NUTS-3 classification, the most disaggregated administrative level in Eurostat.[12] The data construction involves merging of the Euratlas and Eurostat data. In order for us to obtain comparable units, we again use grid-cells to cover the continent. This approach follows existing works in the literature that make use of grid-cells as units of analysis, and potentially run into methodological tradeoffs (Alesina *et al.*, 2011). In our case, we need to determine how to interpret several intersections of land within a grid-cell, in which each different slice of land has a different history of state changes. We also note, however, that such decisions are even more problematic for larger geographic units of analysis, and that the smaller grid-cells instead have the attractive feature of allowing only some of the border changes at a time. Given the various state changes over different centuries, it is otherwise difficult to assess changes using, for example, the entire boundary.[13] Moreover, this approach allows for changes in a sovereign state's territorial size over time. For example, France has been a sovereign state for many centuries but its size has expanded and contracted over time (e.g., expansion during the Napoleon period and contraction thereafter). By using the grid-cell approach, we are able to account for such territorial changes at the borders of the main sovereign state. Similar works have looked at historical conflicts and city locations in Europe (Dincecco and Onorato, 2016) and more recent waves of conflict and global income levels (Tollefsen *et al.*, 2012).

Our grid comprises 10,000 cells, each approximately 77 km × 62 km (see Figure 2). Out of the 10,000 cells, we restrict our analysis to about 2,400 grid-cells that contain some land mass, and to

[12]More information on the NUTS classification is available at http://ec.europa.eu/eurostat/web/nuts/overview.

[13]For example, one may suggest that it would be more natural to instead employ NUTS-3 as the unit of observation. Using the contemporary administrative regions instead of grid-cells could mitigate spatial correlation issues, which arise from increasing the number of adjacent observations with the same values. This approach however also means that specific information pertaining to border changes are necessarily lost by increasing the geographic size of the observation unit. We address the spatial correlation issue below with the inclusion of Conley (1999) standard errors.

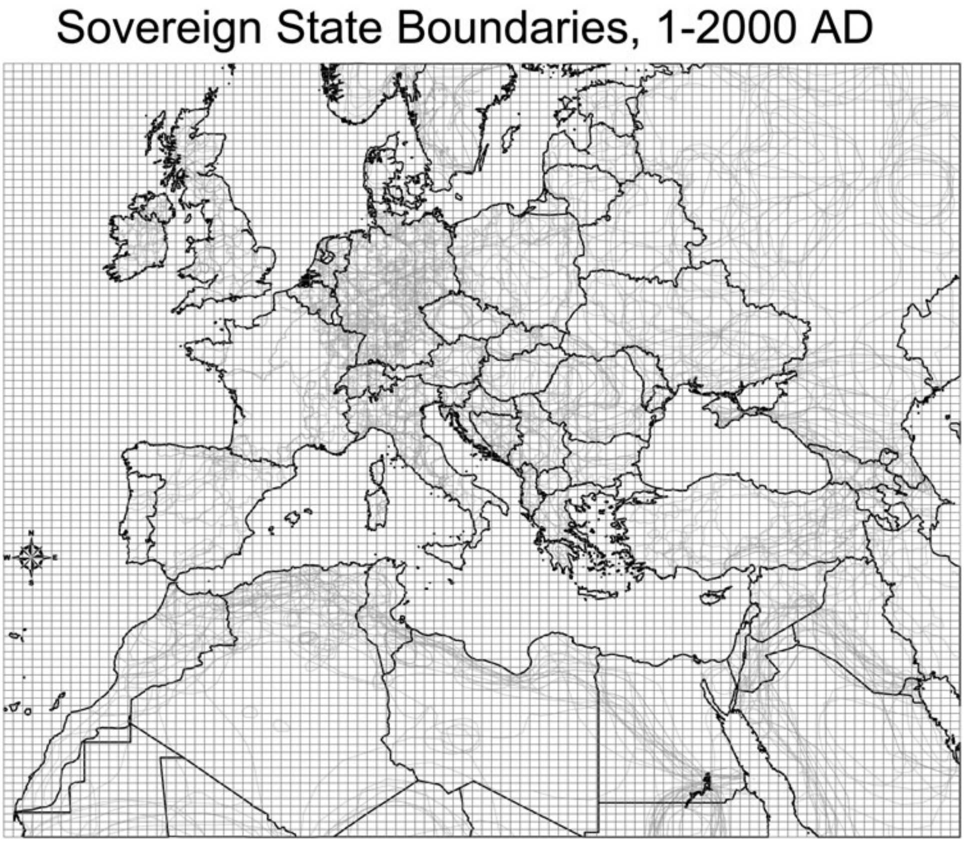

Figure 2. Overlap of Sovereign Entities (1–2000 AD). The above figure presents the overlapped boundaries of all sovereign rulers in Europe based on Euratlas for the period 1–2000 AD along with the grid that comprises 10,000 grid-cells. The boundary in black refers to present-day (year 2000) state boundaries.

sovereign entities that govern at least 0.1 km of the grid-cell area.[14] This ensures that grid-cells only containing water and sovereign rulers that only rule a very small section of the grid-cell are excluded in the analysis. We then identify the sovereign entity that governed a particular grid-cell at the turn of each century. If a grid-cell is part land and part water (e.g., coastal grid-cells), we identify the sovereign entity that govern the land mass in that grid-cell. In addition, if there is more than one sovereign entity that rules a grid-cell in a given year, we use the sovereign entity that governs the maximum area of the grid-cell.

Next, we overlap the grid with NUTS-3 Eurostat maps and calculate the year 2010 GDP per capita for each grid-cell. As before, we restrict the analysis to grid-cells that have some land mass, and to NUTS-3 areas that occupy at least 0.1 km of the grid-cell area. If a particular grid-cell is part of two or more NUTS-3 regions, we use the GDP per capita data based on the NUTS-3 region that occupies the maximum area of the grid-cell. These steps ensure that the process of calculating the regional income data is consistent with that of the sovereign rulers (we also calculate the "average" and "area-weighted" income data for each grid-cell for robustness checks in the Appendix). Figures 3 and 4 show the distribution of the mean state duration and year 2010 GDP per capita for each grid-cell, respectively.

[14]Grid-cells that did not have a sovereign ruler in the year 2000 are considered to not possess any land mass.

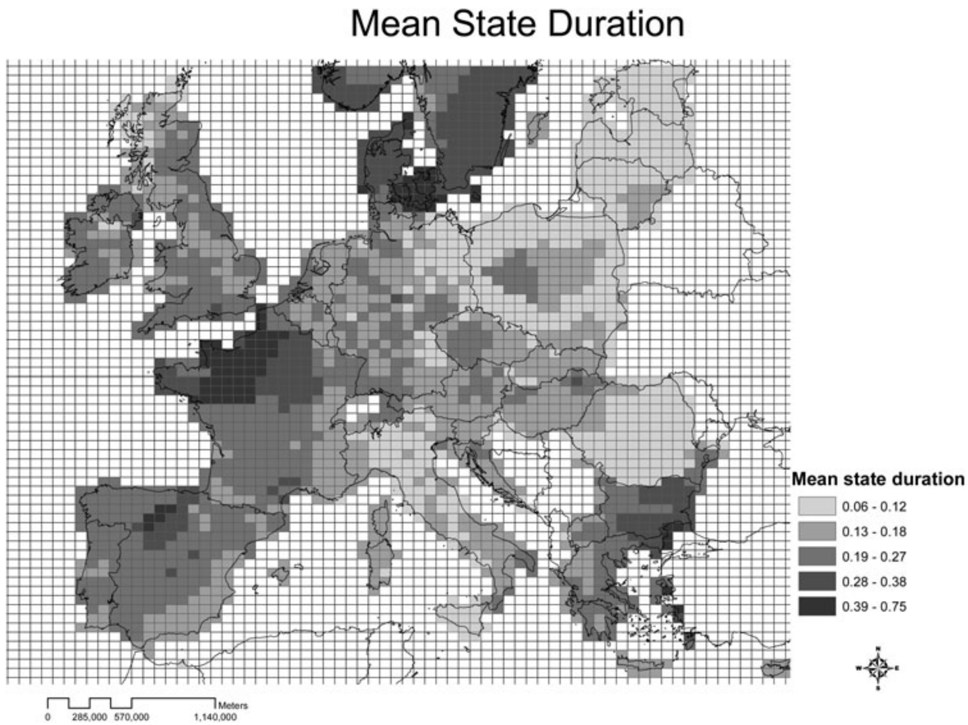

Figure 3. Mean State Duration. The above figure presents the mean state duration based on Euratlas from the year 1 to 2000 AD along with the grid that comprises 10,000 grid-cells. The data are restricted to only those grid-cells that have some land mass. The boundary shown refers to the present-day (year 2000) state boundaries.

In sum, the unit of analysis we use in this paper is the grid-cell. This is a preferable option compared to that of present-day states because the state boundaries have changed over time and there are only a limited number of countries in Europe. The use of the grid-cell as the unit of analysis also ensures that the size of the different units are the same over time and makes it possible to conduct a large-*N* analysis. The main outcome variable is the logged GDP per capita in the year 2010 for each grid-cell (calculated in Purchasing Power Standards thousands of Euros per capita),[15] and the main predictor variable is the mean state duration associated with the grid-cell over the period from 1 to 2000 AD.

For each grid-cell, we calculate the number of centuries during which there was a sovereign state in power, and the total number of unique sovereign entities that governed the same area. We then construct the mean duration of state rule as laid out in Equation 1 above. In addition to the state duration measure, we consider four different alternative explanations of economic development. First, the geographic environment of a region influences its economic development (Sachs, 2001). For instance, agriculturally productive areas are associated with higher levels of production and income (Johnston and Mellor, 1961). In particular, Diamond (1999) and Ashraf and Michalopoulos (2015) argue that the geographical location of Europe made it more suitable for agriculture and domestication of animals that eventually led to the Neolithic Revolution. Especially in periods prior to industrialization, the share of agriculture of the GDP was very high, making agricultural suitability an important determinant of economic

[15]Purchasing Power Standards (PPS) is the term used by Eurostat to calculate GDPs of different regions, taking price-level differences into account. For more information on PPS, see http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/Glossary:Purchasing_power_standard_(PPS), accessed 31 July 2014.

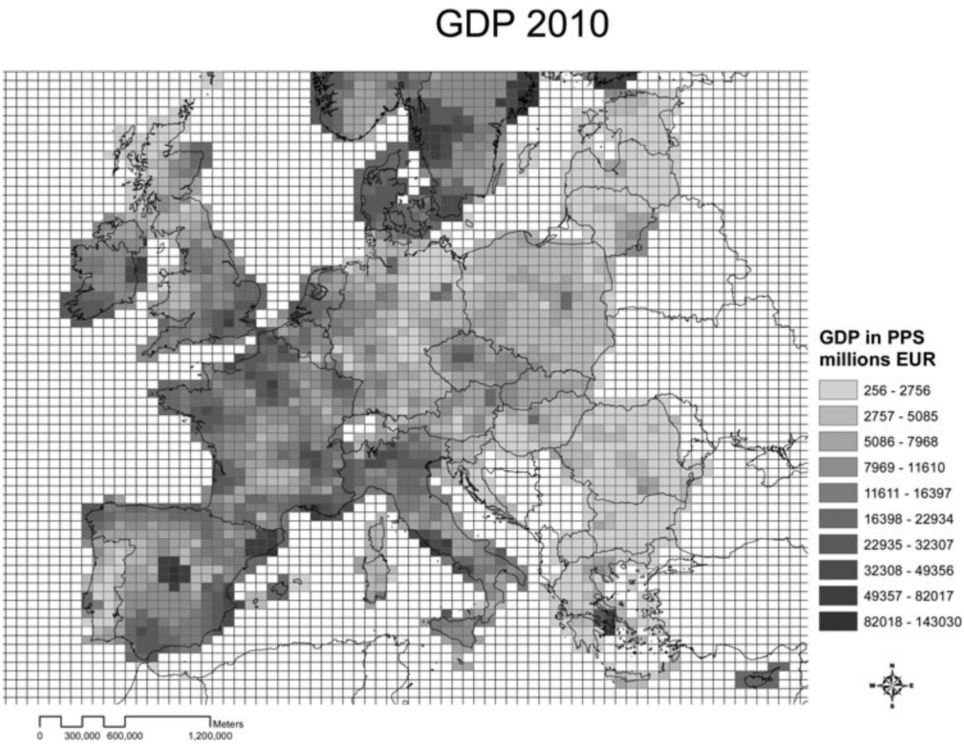

Figure 4. GDP per Capita Distribution. The above figure presents the distribution of GDP per capita based on Euratlas in the year 2000 along with the grid that comprises 10,000 grid-cells. The data are restricted to only those grid-cells have some land mass. The boundary shown refers to the present-day (year 2000) state boundaries.

development and a coveted resource for sovereign states. We obtain agricultural suitability data from Ramankutty *et al.* (2008) and calculate the suitability index for each grid-cell measured as the fraction of land suitable for agriculture. Agricultural suitability is also related to the elevation of a particular region, since high-altitude areas are more conducive to growing certain types of crops. We obtain the mean elevation data from ESRI 2008 GIS Maps.

Second, the European economic growth is associated with the maritime trade, especially in the post-1500 period (Acemoglu *et al.*, 2005). Trade between European countries and their colonies increased the power of traders and merchants who demanded better property rights. In turn, these institutions are associated with higher levels of economic growth in those regions. In addition to arable land, regions with access to water passages would have added more value to sovereign states and potentially witnessed more contestations over them. We control for this mechanism using the distance from the center of a grid-cell to the nearest body of water.

Third, if the frequency of state changes is related to current economic outcomes, then the existence of states before 1 AD may also have lasting influence. While we necessarily limit our calculation of state changes back to 1 AD, one way to control for additional historical state presence is by including the timing of agricultural adoption (Borcan *et al.*, 2018)[16]. That is, we use the

[16]In Borcan *et al.* (2018), the authors show that there is a strong and positive correlation between the timing of agricultural transition and the timing of first state formation. Earlier establishment of states would imply more opportunities for changes and turnovers.

number of years from the adoption date up to the year 2000 (Pinhasi *et al.*, 2005; Olsson and Paik, 2013), as a proxy for the pre-1 AD state influence.[17]

Fourth, the growth of cities is correlated with places moving from an agriculture-based economy to more industrialized forms of production. Cities bring together manufacturing and service arms of different sectors, making the transport of goods, dissemination of information and procurement of labor more efficient (Henderson, 1988; Glaeser *et al.*, 1992; Stasavage, 2014). Moreover, high population densities in cities are seen as essential to increases in labor productivity and economic growth of that region (Ciccone and Hall, 1996). These urban centers are also often targets for invasion due to their wealth and strategic locations, which may lead to more state changes. Hence we control for the distance to the nearest city to account for the impact of urbanization on GDP output.[18]

Finally, we include the geographic coordinates, as well as the year 2000 country indicators, further demanding tests that help control for location and current border shocks. Certain locations, even controlling for geographical endowments and historical development, may witness frequent turnovers simply due to their proximity to the core of Europe, while the peripheries experience less (Merriman, 2003). In addition, we expect that local income levels are likely driven by the state-level unobservables that vary across the modern state boundaries.

Table 1 presents the summary statistics of all the variables used in our analysis. There is considerable variation in the number of unique sovereign states that ruled a given grid-cell. Less than 1 percent of the grid-cells, all of which lie in the peripheral stretches of land by the sea or remote islands, are coded as having been ruled by just one sovereign state, and only one grid-cell was governed by the maximum number of 12 different sovereign states (in Sardinia, Italy). On average, a grid-cell was ruled by five unique sovereign entities over the 21 centuries. As described above, the mean state duration is the fraction of time for which a region was ruled by a sovereign state. This variable ranges between 0.06 and 0.75 with a mean of 0.19, and from Equation 1 this translates to the mean ratio of centuries of rule over the number of unique states being 3.8. Grid cells with mean levels of state rule are located in present-day UK, Ireland and Germany. As shown in the maps earlier, there are also expected variations in the GDP per capita across the continent. On average, the GDP per capita of a grid-cell was about 19,000 PPS euros per thousand people with a fairly high standard deviation of 10,600. The distribution is similar when we use other variations of the logged GDP per capita measure.[19]

4. Mean state duration on development

How is the mean state duration related to the current local income level? On the one hand, Borcan *et al.* (2018) show that both short and long state antiquities lead to low productivity relative to those in the middle range. The former inhibit productivity because of their inability to increase fiscal capacity, while the latter do so as centralized powers become extractive and entrenched in power struggles. But the relationship between the mean duration of state and development may also be non-linear and inverse-U shaped, as the general findings discussed in the literature suggest that turnovers may be associated with state performance. As in Equation 1, the mean duration of state is calculated not only by the length of state presence in a region, but also the number of state turnovers. Holding other things equal, more turnovers imply shorter

[17]We also use the historical population density in 0 AD from History Database of the Global Environment (HYDE) http://themasites.pbl.nl/tridion/en/themasites/hyde/index.html as an alternative measure of historical state development; our main results remain substantively the same.

[18]For the city count, we use all the cities listed in Bairoch *et al.* (1988) and geocode the location of each city. The available population figures in Bairoch *et al.* (1988) capture European cities which had 5000 or more inhabitants between 800 and 1850 AD.

[19]Constructions of these alternative GDP per capita measures are discussed in the Robustness Checks section in the Appendix.

Table 1. Summary statistics.

	mean	SD	min	max	count
GDP per capita (max area)	19.87	11.18	1.61	81.73	2376
GDP per capita (avg)	20.68	11.25	1.61	61.23	2376
GDP per capita (weighted)	20.30	11.16	1.61	74.06	2376
Mean state duration	0.19	0.10	0.05	0.75	2376
Mean state duration (Sq)	0.05	0.06	0.00	0.56	2376
Mean state duration (using turnovers)	0.17	0.16	0.03	1.00	2376
Mean state duration Sq (using turnovers)	0.06	0.16	0.00	1.00	2376
Mean state duration (using disc turnovers)	0.29	0.33	0.04	2.08	2376
Mean state duration Sq (using disc turnovers)	0.19	0.66	0.00	4.32	2376
State presence	16.76	4.40	5.00	21.00	2376
State presence Sq	300.41	138.42	25.00	441.00	2376
Agri adoption	6.79	0.71	5.42	10.08	2277
Agricultural suitability	0.57	0.29	0.00	1.00	2314
Distance to water	81.67	92.08	0.00	462.46	2376
Elevation	297.38	342.54	− 1.85	2304.88	2371
Distance to city	43600.29	128726.43	0.00	2346425.25	2376
Roman empire	3.07	3.50	0.00	14.00	2376
Ottoman empire	0.47	1.36	0.00	7.00	2376
Mongolian empire	0.00	0.05	0.00	1.00	2376
Latitude	48.92	6.66	19.93	60.11	2376
Longitude	10.29	10.94	− 17.46	34.83	2376
Lat*Lon	511.90	536.88	− 574.82	1664.43	2376
Eastern Europe	0.20	0.40	0.00	1.00	2376
Low region	0.02	0.13	0.00	1.00	2376
West Germany	0.05	0.22	0.00	1.00	2376
European city belt	0.11	0.31	0.00	1.00	2376
Europen capital cities	0.02	0.12	0.00	1.00	2376
Number of centuries with capital	0.41	1.33	0.00	14.00	2376
Parliament	0.71	1.74	0.00	7.00	2376
Plunder	0.08	0.40	0.00	5.00	2376
Number of sieges	0.13	0.50	0.00	6.00	2376
Number of battles	0.20	0.63	0.00	9.00	2376

GDP per capita variables are measured in PPS Euros/1000 ppl.

mean durations, a critical distinction that separates a stable state presence from an unstable one. This means that both regions where states had short mean durations and those where they had long durations suffer from lower development. The former has either a short state history, frequent turnovers, or both, while the latter has a long state history, low turnovers, or both.

To see whether the mean duration of state rule is related to the local income level as predicted, we use the following estimation equation for our analyses:

$$Income_i = \beta_0 + \beta_1 * [\text{Mean State Duration}]_i + \beta_2 * [\text{Mean State Duration}]_i^2 + \mathbf{X_i}\beta_3 + \gamma_j + \epsilon_{ij}$$

where $Income_i$ is the logged GDP per capita in the year 2010 in grid-cell i, Mean State Duration$_i$ is the mean duration of state rule, and Mean State Duration^2 is its square. This specifically allows us to examine a non-linear relationship between the mean duration of state and GDP per capita. $\mathbf{X}_i$ contains the list of control variables for grid-cell i including the geographic and urbanization controls. As discussed earlier, geographic controls include the agricultural adoption date, agricultural suitability, distance to water, elevation, and a polynomial of latitude and longitude for each grid-cell. We use the distance to the nearest city as our measure for urbanization. Lastly, we also include country fixed effects in the year 2000 (γ_j) to account for any unobservables that vary across current state borders. The coefficients of interest are β_1 and β_2, both related to the mean state duration variable.

5. Main findings

We present our main findings in Table 2. Column one is the baseline model where the logged GDP per capita in the year 2010 is regressed on the mean duration of state rule between 1 and 2000 AD and its squared term. The mean duration of state rule has a positive coefficient estimate whereas the squared term has a negative coefficient estimate, and both estimates are statistically significant at the one percent level. This suggests that there is a non-linear relationship between mean duration of state rule and GDP per capita. The signs on the two coefficient estimates suggest an inverse-U relationship: the mean duration of state rule is associated with higher income levels but this relationship tapers off and ultimately becomes negative as state rule continues for more centuries.

Columns 2–6 progressively introduce different control variables. In all models, the positive and statistically significant coefficient estimate of the mean duration of state rule and the negative and statistically significant coefficient estimate of its squared term are present at the one percent significance level. All seven models include country fixed effects in the year 2000 to account for possible unobservables in current state boundaries that could affect the GDP per capita of a region. The sign and statistical significance of the mean state duration variable and its squared term remain consistent across all models, providing us with robust evidence on the inverse-U shaped relationship.

Figure 5 presents the inverse-U relationship between the mean state duration and the GDP per capita based on the full model in Table 2. It plots the predicted values of GDP per capita (along with the standard errors) as the mean state duration varies between values of 0 and 1 . The figure shows that the logged 2010 GDP per capita increases with the mean state duration but does so only up to point. As the mean state duration goes beyond 0.3, its association with the logged GDP begins to decrease. To substantively make sense of these findings, we present the marginal association of mean state duration on the change in the 2010 logged GDP per capita levels in Figure 6, holding all other controls at their mean levels. The figure shows that the marginal effect of states has a positive association on income initially but that this effect is decreasing and ultimately turns negative.

In the Appendix, we provide further support for our results through additional robustness tests. First, we include state presence as a separate control from the mean state duration variable. We also include indicators for specific empires, whose rule determined long-term economic growth (ex. Roman Empire), as well as certain regions that experienced different levels of state capacity (ex. the European "city belt"). Next, we address issues on institutions and violence; some European cities developed parliaments while others were plundered during the last 2000 years. Finally, we explore alternative measures of state turnovers and development, as well as potential spatial correlations between different grid cells. Our results remain robust under these additional checks.

6. Discussion

It is difficult to conceptualize how regions that have on average stable rule for up to a certain level see positive development but stagnate once the state duration becomes too long, as this may depend on the time span as well as the period in history which one looks at. Another potential concern is with the conceptualization of statehood, which likely changed over time. Since the definition of a state described above may be considered more suitable in describing a modern Weberian state, one may argue that states in earlier periods should instead be defined simply as a form of political organization above the tribal level (Borcan *et al.*, 2018). North (1990) indeed argues that formal institutions only became necessary relatively late in the process of

Table 2. Mean state duration on logged 2010 GDPPC.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mean state duration	0.944***	1.006***	1.054***	1.155***	1.157***	1.119***	0.868***
	(0.157)	(0.159)	(0.160)	(0.160)	(0.163)	(0.166)	(0.171)
Mean state duration (Sq)	– 1.327***	– 1.420***	– 1.473***	– 1.605***	– 1.631***	– 1.579***	– 1.390***
	(0.193)	(0.195)	(0.196)	(0.198)	(0.197)	(0.200)	(0.205)
Agricultural suitability		✓	✓	✓	✓	✓	✓
Elevation			✓	✓	✓	✓	✓
Distance to water				✓	✓	✓	✓
Agri adoption					✓	✓	✓
Distance to city						✓	✓
Latitude							✓
Longitude							✓
Lat*Lon							✓
Country FE in Yr2000	✓	✓	✓	✓	✓	✓	✓
Observations	2376	2314	2313	2313	2223	2223	2223

The outcome variable in all of the above models is the logged GDP Per Capita in the year 2010 (in PPS thousands EUR per thousand people). All models include country fixed effects in the year 2000, and robust standard errors are shown in parenthesis. *p<0.10, **p<0.05, ***p<0.01.

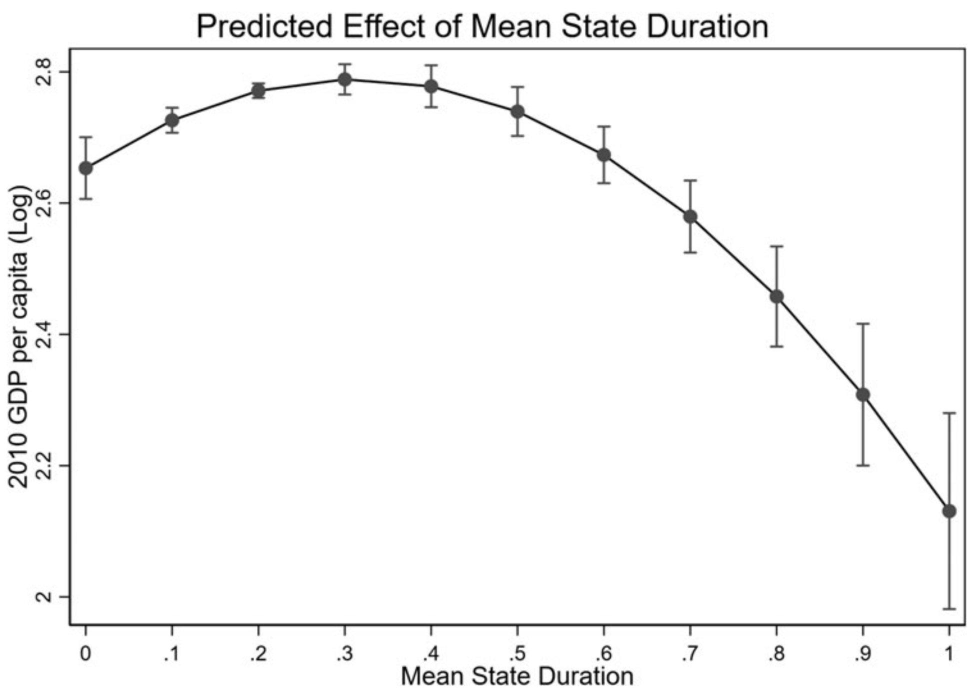

Figure 5. Quadratic Relationship between Mean State Duration and logged GDP per capita.

development; while state rule can reduce transaction costs and protect property rights, these mechanisms may have been stronger in the later stages of the time period.

One feasible way to address these concerns is to explore whether the inverse-U relationship is evident if we choose different time period cutoffs. For this purpose, we construct our mean state duration variable for different time periods by using the same structure as Equation 1, but restricting the number of states and number of centuries of state presence based on the duration under consideration. As an example, in order to compute the state duration for the time period between 1000 and 2000 AD, we first identify the number of unique sovereign states that governed

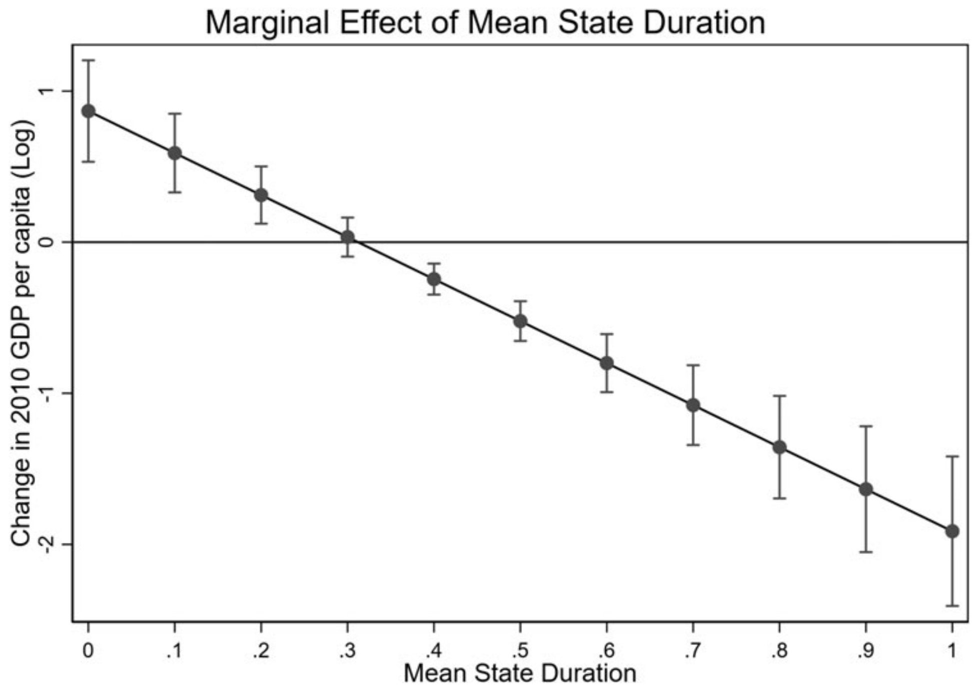

Figure 6. Linear Marginal Effect of Mean State Duration on logged GDP per capita.

each grid cell and the number of centuries of state presence for this time period. Then we divide the number by 10 centuries, giving us the mean state duration for the time period 1000–2000 AD. This construction ensures that the mean state duration variable is always between 0 and 1, making it comparable across different time periods.[20]

We consider several guiding examples for comparison. First, we look at the time span between 500 and 2000 AD, following the Roman Empire's apex in around 400 AD. The left panel of Figure 7 presents margins plots when the mean state duration is calculated using the period 500--2000 AD, and it shows an inverse U-shaped association as in the period between 1 and 2000 AD, suggesting that the relationship holds for states under the Roman legacy. We also look at the beginning of the feudal revolution in 800 AD that led to the divergence of Western Europe from the rest of the world (Blaydes and Chaney, 2013). The middle panel of Figure 7 shows that the period between 800 and 2000 AD exhibits a similar pattern as in the longer time span, confirming that the non-linear relationship holds over the early rise of the West and its present aftermath. Finally, we consider the critical transition to modern statehood in Europe. The concept of sovereignty had begun to change from 1400 AD and onwards (Tilly, 1992; Benton, 2009), and Europe witnessed the type of modern state formation that was unseen in the previous centuries. The right panel of Figure 7 shows the margins plots from 1400 to 2000 AD. Over this period, we again find a similar empirical pattern as in the 1 to 2000 AD time interval. These findings together suggest that the aforementioned empirical pattern appears to remain consistent across different time spans.[21]

[20]We also note that the conversion of mean state duration to the number of centuries depends on the time span considered. For example, for the time period 1–2000 AD, a mean state duration of 0.3 would correspond to 6 centuries, while for the time period 1000–2000 AD, a mean state duration of 0.3 would correspond to 3 centuries.

[21]As an additional check, Figure S1 in the Appendix presents the relationship between mean state duration calculated for different period intervals and 2010 logged GDP per capita. When we confine the time span to only the most recent centuries

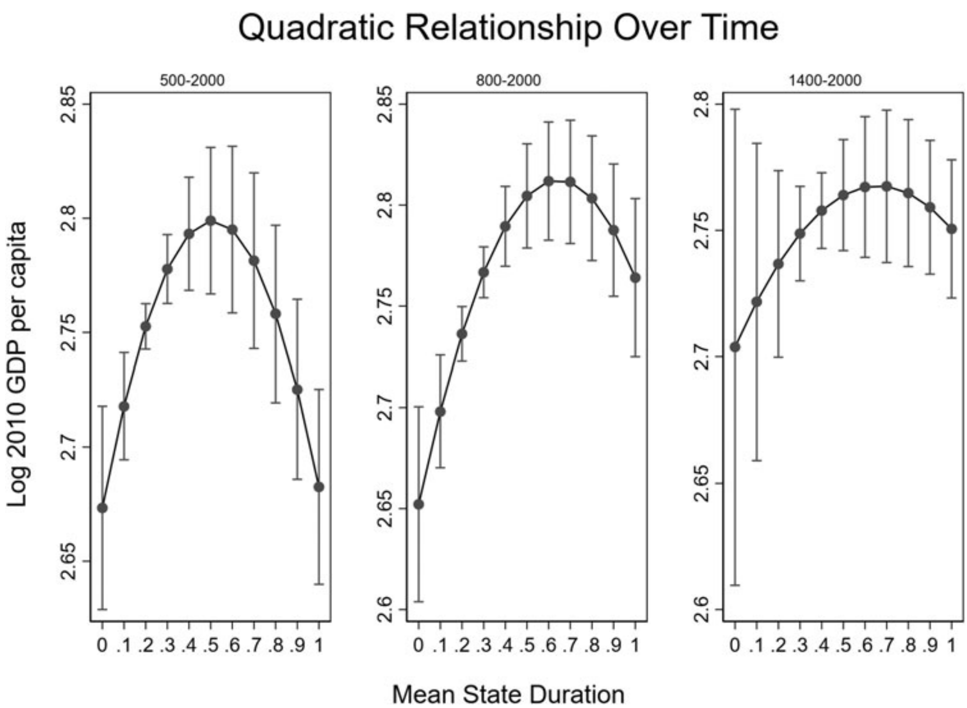

Figure 7. Quadratic Relationship between Mean State Duration and GDP per capita for three different time periods.

There are a couple of extensions to our main findings which we discuss here. First, one may wonder whether historical turnovers are associated with income levels in much later time periods. That is, we may observe persistent differences in incomes that are attributed at least in part to how unstable the state was centuries ago. Using our data, we are able to test this persistence effect to some extent. In order to see whether turnovers in the past are correlated with differences in incomes centuries later, we regress the year 2010 income levels on the mean state duration calculated between 1 (the baseline year) and 1900 AD, 1 and 1800 AD, 1 and 1700 AD and so on. Figure S2 presents the results; we see that the income level in 2010 continues to have a strong non-linear relationship with mean state duration in the past up to 6 centuries ago (as evident in the graph with the mean state duration calculated between 1 and 1400 AD). This finding is in support of numerous works documenting persistent effects of historical institutions and culture on subsequent economic development in the long run (e.g., (Banfield, 1958; Putnam *et al.*, 1993; Tabellini, 2010; Spolaore and Wacziarg, 2013)).

Related to this finding, we can also explore cultural mechanisms behind the persistence effect. For this exercise, we use a number of cultural attitude measures obtained from the 2010 European Social Survey. We follow Tabellini (2010)'s approach in measuring three types of cultural norms that are positively associated with economic development (*trust, respect and control*) and another that is negatively associated (*obedience*).[22] Table S5 in the Appendix shows that the cultural

with short time spans, we do not have a clear direction on how the variation in mean state duration may be associated with the outcome. These inconsistencies are, however, smoothed out and a consistent pattern emerges when the analysis is carried out over longer time intervals. For every time span between 1400 and 2000 AD, 1300 and 2000 AD and so on, we find that the relationship is consistently inverse U-shaped, similar to our main finding from the 21 century time-span.

[22]On *trust*, we take the NUTS3-mean score from the variable with responses on the following question: "Most people can be trusted (score of 10) or cannot be too careful (score of 0)." On *respect*, we take the mean score from the variable with responses on the following: "[How important is it] that people are treated equally and have equal opportunities." On *control*,

attitudes as outcomes generally exhibit the inverse-U relationship when regressed on the mean state duration from 1 to 2000 AD, as in our main results. Among the cultural measures, the *control* measure in particular is statistically significant. Using this measure, Figure S3 in the Appendix shows that the mean state duration calculated over time intervals in the past again shows a persistent nonlinear relationship with the cultural outcome variable. These findings give further support to the idea that historical state stability may explain persistent variation in cultural attitudes, which in turn are instrumental to income differences.

7. Conclusion

In this paper, we introduce a measure of mean duration of state rule and show a strong and inverse U-shaped relationship between the variable and the current local income level. Using data from a vast time period (1–2000 AD) in Europe, we find that regions under either short or long mean duration of state rule also witness lower economic standings today relative to others. In line with existing empirical and theoretical works in the literature, our empirical findings suggest that state presence is important for economic development, and the length of its duration signals stronger fiscal capacity and subsequent development. At the same time, they also suggest that a region may benefit from opportunities for state turnovers when the surviving states, after long duration, become overly extractive and hinder progress.

As our findings stand robust to various controls and alternative measures, we believe that there are several potential avenues for future research. First, this paper focuses on Europe partially due to the data availability of sovereign state changes and GDP per capita at the micro-level. A fruitful exercise would be to extend this analysis to other parts of the world, especially in places formerly under European colonial rule. The current works on these regions have mainly focused on the effect of European colonization on economic growth (Acemoglu *et al.*, 2001; Banerjee and Iyer, 2005), and we do not yet know if this is a result of an accumulation of sovereign state presence and their changes over time, or if the European colonization was the main determinant of development in these regions.[23] Another apt region to test our hypothesis would be China, where despite the sizable land mass there were significantly fewer sovereign state changes over the same time period.

A second research avenue would be in exploring the association between state changes and the emergence of democracy. Each sovereign entity in the modern period could be coded as a monarchy, autocracy or democracy based on extension of suffrages and existence of monarchies. Much of the existing literature have focused on the dichotomy between autocracies and democracies, and its relation to economic growth (Przeworski *et al.*, 2000). With the availability of sovereign state data over the past 2000 years, one may examine the root of divergence of modern states, explore the extent to which monarchies differ from autocracies and democracies in delivering growth, or whether a certain level of economic output is required before transitioning from monarchy to democracy or autocracy.

Finally, one can also explore the given data by investigating the extent to which the duration of each sovereign state is a function of geographic factors. For example, the existing set of maps affords the possibility of contributing to the current literature on the relationship between the polity size, the level of decentralization and the duration of polity (Alesina and Spolaore, 1997; Stasavage, 2010). Big states benefit from economies of scale when providing non-rival public goods as well as from the size of markets, and may rely on more efficient forms of taxation;

we take the mean score from the variable with responses on the following: "Important to make own decision and be free." Finally on *obedience*, we take the mean score from the variable with responses on the following: "Important to do what is told and follow rules." Each of the *respect, control and obedience* measures ranges in value from 1 to 6.

[23]A recent paper by Maloney and Valencia (2015) suggests that pre-colonial prosperity explains the current level of economic activity; similarly pre-colonial institutional variables, including turnovers, may have a persistent effect independent of colonization.

smaller countries, on the other hand, benefit from lower communication and transport costs. The size of states in each period can therefore be seen as an endogenous outcome of both political and economic outcomes, such that the geographic scale of a state may provide a signal for its survival in the next period (Aköz *et al.*, 2018).

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