Historical State Stability and Economic Development in Europe
Supporting Information

March 17, 2019

Contents

S1 Robustness Checks

S1.1 State Presence, Specific Empires & Specific Regions

The association between the mean state duration and GDP could depend on certain regions having different historical experiences than others. First, the very presence of a state could affect the economic outcomes of a region. Even though we take state presence into account when we construct the mean state duration variable, we now include an additional non-linear functional form of the variable in our estimations. In so doing, we show that our results on mean state duration are robust to the direct influence of state presence on GDP.

Second, areas of Europe that witnessed domination by certain empires may have benefitted in terms of economic growth because of institutions that survived since that time.[1] In addition to the Roman Empire's rule, which is often discussed in the literature as an important determinant of a region's long term economic growth (Duncan-Jones 1982; Temin 2006), there are other successful and historically significant empires that we can explore in the analysis. These include the Mongolian and Ottoman Empire, and for each of these empires we can calculate the duration (in centuries) of its rule on the grid-cell. We thus include as controls the number of centuries that a grid cell was under the Roman, Ottoman and Mongolian rule during the past 2000 years to account for the effect of these specific empires.

Third, different regions of Europe have had different levels of state capacity, and economic development in some parts of the continent today may be the result of specific geographies or historical events. While modern country dummies in our regressions control for most of these effects, [2] some do not align with current borders, and other run over multiple states. One region that may have a different economic path is West Germany, especially the Rhineland, which consisted of several hundred small states from the Kingdom of the Romans and the Small States of the Holy Roman Empire after the Great Interregnum (1254 to 1273). In our data, the Kingdom of the Holy Roman Empire as a single entity encompasses approximately 400 small lordships and principalities within the territory, whose boundaries were in some cases unknown. Because these data are absent and this area was amongst the wealthiest throughout history, the results from treating it as one entity may be biased against a positive effect.[3]

Another region of potential importance is the European "city belt" (also known as "city-state

[1]Empires may have also enabled increased trade and led to economic integration for constituent nations, leading to higher economic growth; see Mitchener and Weidenmier (2008). Not all empires facilitated integration and trade, however; see Nexon and Wright (2007).

[2]For example, communist legacies in Eastern Europe may be partially responsible for economic outcomes today (Pop-Eleches 2007). Similarly, the geography and institutional structure in the Low Countries may lead to different economic trajectories from the rest of the continent (Bavel 2010; Mokyr 1977).

[3]While the Euratlas maps have been deemed accurate and accepted as valuable source in the recent literature (Abramson 2017; Blaydes and Chaney 2013; Blaydes and Paik 2016; Stasavage 2010), there are bound to be discrepancies in terms of which states should be included and which should not. In some cases, small principalities, ecclesiastical units and city states may be classified as sovereign states but missing from these maps.(Abramson 2017). The Euratlas sample identifies a maximum of 158 sovereign states in a given century over the time span, which some argue under-count the actual number (for example, (Tilly 1975) claims that in 1500 there were 500 independent political units in Europe). Most of the under-counting appears to have resulted from the Rhineland as described here.

Europe"), stretching from northern Italy, through the Alps and southern Germany, to the Low Countries; these cities along the Rhine river in the center of Europe constituted a commercial continuum out to the North and Baltic Seas. They were strong enough to deter any centralizing effort in establishing a territorial state in their locations, and as a result, modern territorial states developed in areas that were peripheral to this core.(Abramson 2017; Rokkan 1975) In order to alleviate doubts that the city belt might be driving our main results, we control for the grid cells in this region. Finally, we also control for contemporary capital region-grid cells to assess whether in addition to regional effects, our results are simply driven by important cities influencing the regional development today.

	(1)	(2)	(3)	(4)
Mean State Duration	0.436**	0.811***	0.699***	0.703***
	(0.175)	(0.178)	(0.170)	(0.170)
Mean State Duration (Sq)	-0.926***	-1.338***	-1.170***	-1.168***
	(0.206)	(0.214)	(0.202)	(0.203)
State Presence	✓			
State Presence Sq	✓			
Roman Empire		✓		
Ottoman Empire		✓		
Mongolian Empire		✓		
Eastern Europe			✓	✓
Low Region			✓	✓
West Germany			✓	✓
European City Belt			✓	✓
European Capital Cities			✓	
Number of Centuries with Capital				✓
Agricultural Suitability	✓	✓	✓	✓
Elevation	✓	✓	✓	✓
Distance to Water	✓	✓	✓	✓
Agri Adoption	✓	✓	✓	✓
Distance to City	✓	✓	✓	✓
Latitude	✓	✓	✓	✓
Longitude	✓	✓	✓	✓
Lat*Lon	✓	✓	✓	✓
Country FE in Yr2000	✓	✓	✓	✓
Observations	2223	2223	2223	2223

Table S1: Mean State Duration on logged 2010 GDPPC (controlling for state presence, specific empires and specific regions). The outcome variable in all the above models is the logged GDP Per Capita in year 2010 (in PPS thousands EUR per thousand people). All models include country fixed effects in year 2000, and robust standard errors are shown in parenthesis. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Table S1 presents the results of the three potential concerns discussed above. Model 1 includes the state presence variable and its square term aimed at isolating the direct effect that state presence may have on the region's economic output. Our main mean state duration variable and its square term continue to have positive and negative signs respectively, and both variables also continue to remain statistically significant. Similarly, Model 2 presents results after controlling for the number of centuries under the Roman, Ottoman and Mongolian rule. As before, we find that the mean state duration and its square term continues to have positive and negative signs respectively, and both coefficients remain statistically significant. This remains true in Model 3 as well when we include controls for different European regions as well as contemporary capital region-grid cells. To take into account historical European capitals, we also include the number of centuries with a capital as a control in Model 4 along with other regional controls.[4] Taken together, these results increase our confidence that the mean state duration has a inverse U-shaped relationship with GDP.

S1.2 Parliament & Plunder

Despite remaining robust to the geographic and political controls above, it remains to be seen whether our findings hold when accounting for local variations in the type of institutions that governed each grid-cell. In political economy models, autocratic institutions can either undermine or countervail vested interests from taking root, while representative institutions may have correlated with longer regimes because they were better able to establish checks on unpopular and therefor brittle governments (Besley and Persson 2009; Blaydes and Chaney 2013; Cox, North, and Weingast 2015). Given the long-standing political fragmentation as a fundamental part of European history, there has also been much emphasis on looking at institutions at the city level (Stasavage 2014). Furthermore, there is evidence that violence which may accompany transitions can have long-term negative effects on economic, health, and educational outcomes (Abadie and Gardeazabal 2003; Akresh and Walque 2008; Chamarbagwala and Morán 2011), sometimes sustaining over more than one generation (Harish 2015).

	(1)	(2)	(3)	(4)	(5)	(6)
Mean State Duration	0.848***	0.869***	0.849***	0.848***	0.868***	0.853***
	(0.171)	(0.171)	(0.171)	(0.171)	(0.171)	(0.170)
Mean State Duration (Sq)	-1.376***	-1.389***	-1.371***	-1.379***	-1.393***	-1.384***
	(0.205)	(0.205)	(0.205)	(0.205)	(0.204)	(0.204)
Parliament	✓		✓			
Plunder		✓	✓			
Number of Sieges				✓		✓
Number of Battles					✓	✓
Agricultural Suitability	✓	✓	✓	✓	✓	✓
Elevation	✓	✓	✓	✓	✓	✓
Distance to Water	✓	✓	✓	✓	✓	✓
Agri Adoption	✓	✓	✓	✓	✓	✓
Distance to City	✓	✓	✓	✓	✓	✓
Latitude	✓	✓	✓	✓	✓	✓
Longitude	✓	✓	✓	✓	✓	✓
Lat*Lon	✓	✓	✓	✓	✓	✓
Country FE in Yr2000	✓	✓	✓	✓	✓	✓
Observations	2223	2223	2223	2223	2223	2223

Table S2: Mean State Duration on logged 2010 GDPPC (controlling for parliament presence and city plunder). The outcome variable in all the above models is the logged GDP Per Capita in year 2010 (in PPS thousands EUR per thousand people). All models include country fixed effects in year 2000, and robust standard errors are shown in parenthesis. * p<0.10, ** p<0.05, *** p<0.01.

For an additional analysis controlling for both representative institutions and violence experienced, we utilize the city-level data from 800 AD to 1800 AD in Bosker, Buringh, and Zanden

[4] Historical capital locations from 1 to 2000 AD are obtained from Pierskalla, Schultz, and Wibbels (forthcoming).

(2013). The data set contains information on whether a given city had an active parliament, and whether it experienced any physical plundering in the previous century.[5] For each grid-cell, we find out whether there is a city, and count the number of centuries for which the city had an active parliament from 800 to 1800 AD, as well as the number of centuries for which the city was plundered.[6] As an alternative measure of violent incidents, we also utilize Dincecco and Onorato (2017a)'s data, which geo-locate sieges and battles in Europe between 1000 and 1799 AD. Table S2 presents results in which each variable is added first separately and then jointly to the base estimation equation. We find that our main results stay robust to the inclusion of these additional controls.[7]

S1.3 Alternative Measures

An alternative measure for state changes, instead of the number of unique sovereign states, can be the actual number of turnovers that states experienced. Turnovers may refer either to a new entity that has not ruled the region previously, or an old entity that has ruled the area before and returns to power. The variable thus allows for a higher count of changes than the number of unique states, because an old sovereign state coming back to reclaim its land would be counted in the former but not in the latter. To see the difference between turnovers and the number of unique sovereign states, consider a hypothetical region ruled by the following kingdoms in chronological order: Romans, French, Ottoman, French, Ottoman, and the Republic of Germany - in this case, there are four unique sovereign state owners but five sovereign state turnovers. Models 1 and 2 in Table S3 presents our the full model taking all controls into account. In Model 1, we use the number of turnovers rather than number of unique sovereign states to calculate the mean state duration, and in Model 2, we weigh the turnovers according to the time period; that is, we allow higher weights for turnovers that occurred closer to year 2000 and discount those that occurred further back in time. This addresses a main limitation with our data, in which we are unable to differentiate the level

[5] According to Bosker, Buringh, and Zanden (2013), the first parliaments convened in twelfth and thirteenth-century Spain, Italy, and France, spreading over the rest of Europe in the following centuries. Plunder is defined as "the near complete demolition, looting, carnage or burning down of a city or the killing or deportation of the major part of its inhabitants."

[6] In the case that there are multiple cities within a grid-cell, we aggregate both parliament and plunder information at the grid level for a given century (based on whether any of the cities had an active parliament or was plundered), and then count the number of centuries with this feature.

[7] We conduct mediation analysis to further examine the extent to which proxies for "contested land" could mediate the overall effect of state turnovers. The two variables are the number of battles and number of sieges, both from Dincecco and Onorato (2017b). For the mediation analysis, we use Preacher and Hayes (2008)'s approach and report the proportion of total effect that is mediated along with bootstrapped standard errors. We find that both battles and sieges only contribute very minimally to the direct effect. The proportion of total effect that is mediated via battles is only 0.2 percent (and is statistically insignificant). Similarly, the proportion of the total effect that is mediated via sieges is only 2 percent (and is statistically significant). For comparison, we also conducted a similar analysis with other possible mediators such as the existence of a parliament or a plundered city. We find that the proportion of the total effect that is mediated via parliaments is 1.8 percent (and is statistically insignificant). Similarly, the proportion of the total effect that is mediated via plunder is 0.3 percent (and also statistically insignificant). Taken together, these results suggest that while state turnovers are weakly correlated with the number of sieges, the proportion of the mediated effect is small, and that the direct correlation with present-day income levels is still strong.

of state capacity and strength across time periods. By collapsing state presence and the number of unique states into a scalar measure, we are likely placing more weight to the states in the past as opposed to the more recent periods.[8] In both models, our main result implications remain essentially the same.

	(1) GDPPC Max Area	(2) GDPPC Max Area	(3) GDPPC Average	(4) GDPPC Weighted
Mean State Duration (Using Turnovers)	0.441***			
	(0.138)			
Mean State Duration Sq (Using Turnovers)	-0.469***			
	(0.127)			
Mean State Duration (Using Disc Turnovers)		0.215***		
		(0.064)		
Mean State Duration Sq (Using Disc Turnovers)		-0.110***		
		(0.026)		
Mean State Duration			0.957***	0.948***
			(0.173)	(0.167)
Mean State Duration (Sq)			-1.464***	-1.450***
			(0.208)	(0.201)
Agricultural Suitability	✓	✓	✓	✓
Elevation	✓	✓	✓	✓
Distance to Water	✓	✓	✓	✓
Agri Adoption	✓	✓	✓	✓
Distance to City	✓	✓	✓	✓
Latitude	✓	✓	✓	✓
Longitude	✓	✓	✓	✓
Lat*Lon	✓	✓	✓	✓
Country FE in Yr2000	✓	✓	✓	✓
Observations	2223	2223	2223	2223

Table S3: Using Alternative Measures of Mean State Duration and 2010 GDPPC. The outcome variable in Models 1 and 2 is the logged GDP Per Capita in year 2010 (in PPS thousands EUR per thousand people) calculated using the maximum area within a grid-cell. The outcome variable in Models 3 and 4 are similar in that it is the logged GDP calculated using the average and weighted area within a grid-cell. All models include country fixed effects in year 2000, and robust standard errors are shown in parenthesis.* $p<0.10$, ** $p<0.05$, *** $p<0.01$.

Next, since we calculate economic development using a new geographic unit of analysis, our results may be dependent on how we measure the outcome variable. In order to check whether the findings are robust, we also consider alternative measures of different variables to provide robustness of our results. First, we examine alternative measures of our outcome variable, the logged GDP per capita in the year 2010. For our main findings, we used the value associated with the region that covered the maximum area of the grid-cell when there were two or more NUTS-3 regions within a grid-cell. Here we present results where the outcome variable is calculated using (1) the simple average, and (2) the area-weighted average of the different NUTS-3 regions. Table S3 presents the full model as in our main findings, and the mean state duration continues to have an inverse U-shaped statistically significant relationship in all models.

[8] Here we use the historical discount factor x to be 0.05, where each turnover is discounted by $(1+x)^t$ and t is the number of centuries prior to 2000 AD.

S1.4 Spatial Autocorrelation

Our main results assume that different grid-cells are independent and identically distributed. However, because some grid-cells are in close geographic proximity to others, it is possible that they influence the variables of interest in neighboring grid-cells. This is especially the case in our empirical approach, given that a representative political entity often occupies multiple grid-cells, and all the same attributes of the entity are assigned to these grid-cells that are adjacent to each other. We have found that areas of historically high turnovers overlap with areas of lower income levels today, but if we want to estimate the relationship between state changes and the development outcome today without controlling for spatial autocorrelation, we may obtain biased estimates. In order to check whether the negative relationship between the two variables holds under potential spatial autocorrelation, we present the coefficient estimates with standard errors adjusted for spatial autocorrelation in table S4. Controls are introduced progressively like in our main table, and we find that similar to our baseline results, the inverse-U relationship between the mean state duration and present-day GDP per capita continues to hold.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mean State Duration	0.944***	1.006***	1.054***	1.155***	1.157***	1.119***	0.868***
	(0.269)	(0.267)	(0.264)	(0.265)	(0.272)	(0.276)	(0.280)
Mean State Duration (Sq)	-1.327***	-1.420***	-1.473***	-1.605***	-1.631***	-1.579***	-1.390***
	(0.318)	(0.318)	(0.314)	(0.317)	(0.313)	(0.318)	(0.328)
Agricultural Suitability		✓	✓	✓	✓	✓	✓
Elevation			✓	✓	✓	✓	✓
Distance to Water				✓	✓	✓	✓
Agri Adoption					✓	✓	✓
Distance to City						✓	✓
Latitude							✓
Longitude							✓
Lat*Lon							✓
Observations	2376	2314	2313	2313	2223	2223	2223

Table S4: Mean State Duration on logged 2010 GDPPC (using Conley (1999, 2008) standard errors). The outcome variable in all the above models is the logged GDP Per Capita in year 2010 (in PPS thousands EUR per thousand people). All models include country fixed effects in year 2000, and Conley standard errors are shown in parenthesis.* $p<0.10$, ** $p<0.05$, *** $p<0.01$.

S2 Different Time Periods

This section provides information on the quadratc relationship between mean state duration and GDP per capita for different time periods..

- Figure S1 presents the quadratic relationship between mean state duration and GDP per capita for time periods XXXX-2000.
- Figure S2 presents the quadratic relationship between mean state duration and GDP per capita for time periods 1-XXXX.

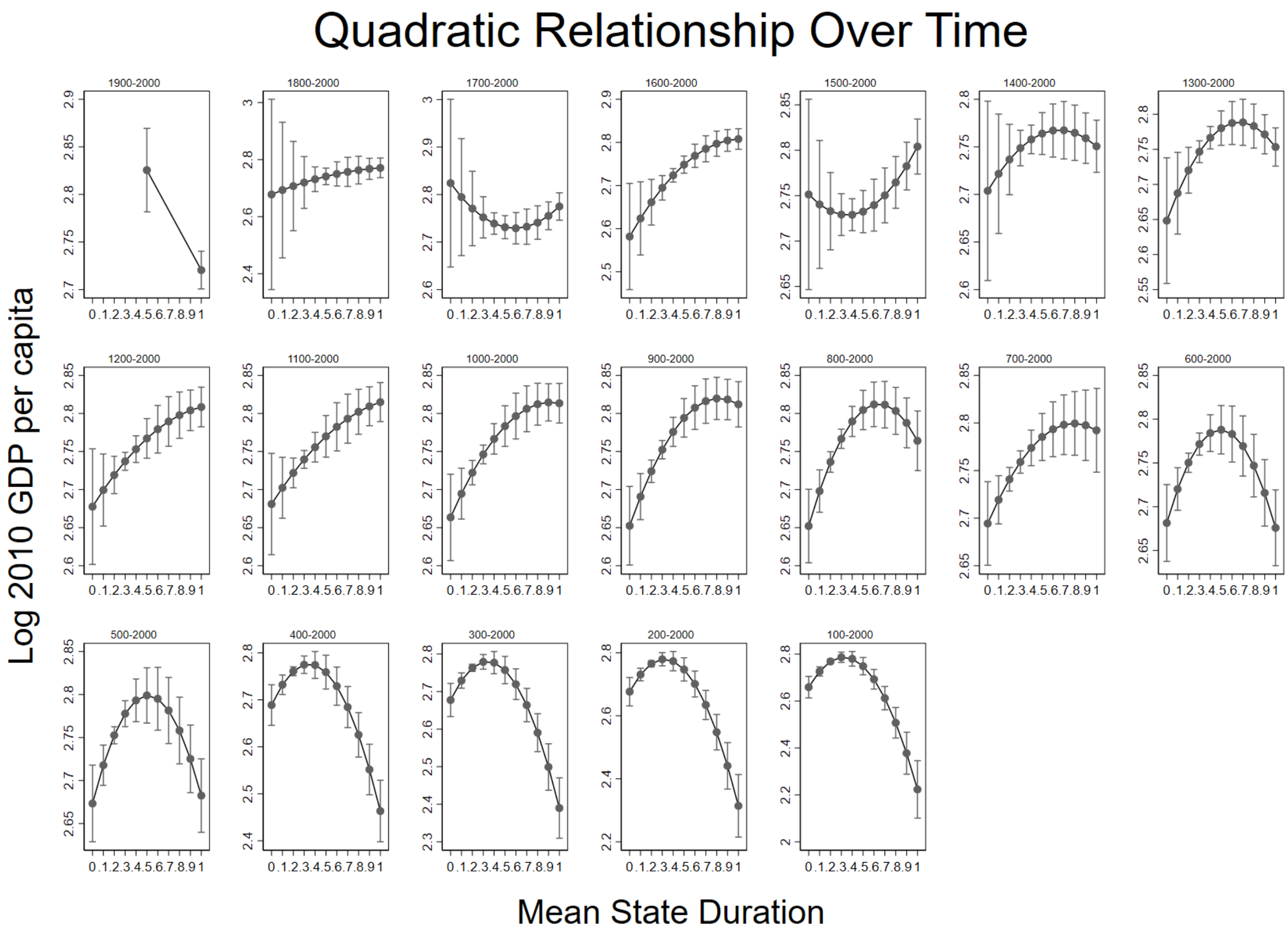

Figure S1: Quadratic Relationship between Mean State Duration and GDP per capita for different time periods (XXXX-2000).

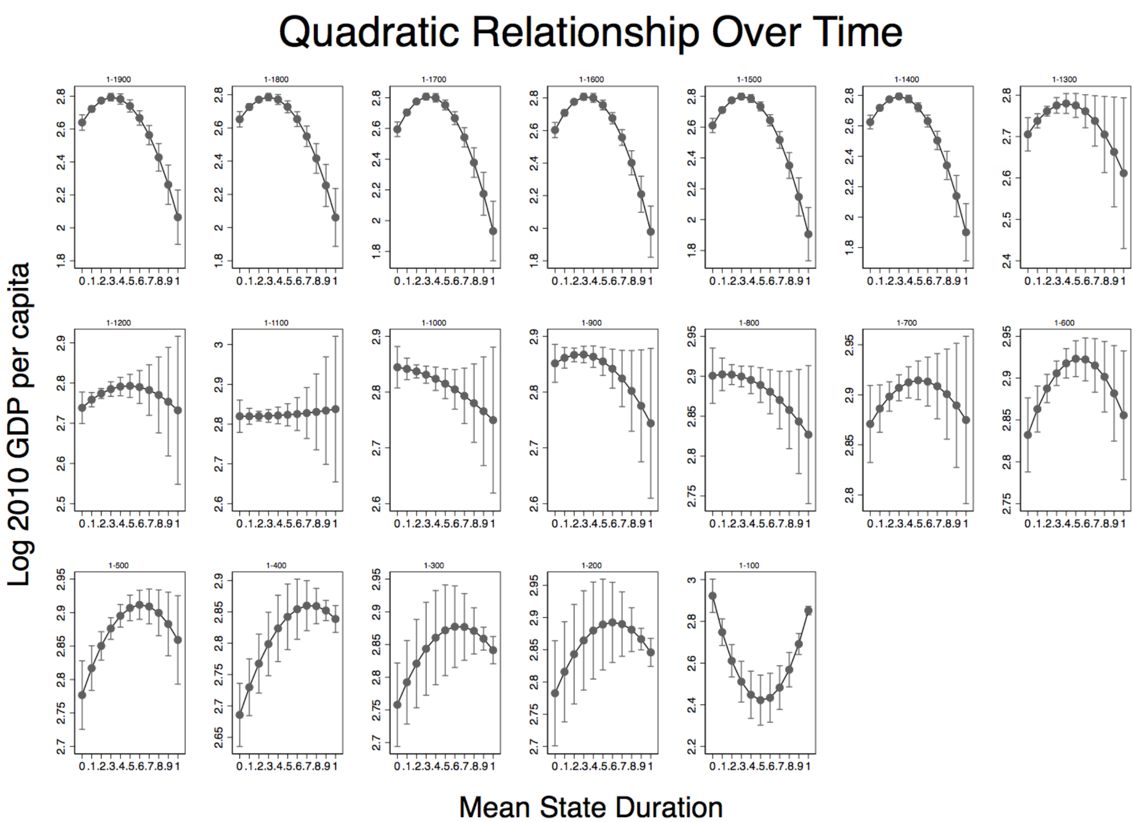

Figure S2: Quadratic Relationship between Mean State Duration and GDP per capita for different time periods (1-XXXX).

S3 Cultural Attitudes

This section provides information on the relationship between mean state duration and cultural attitudes.

- Table S5 presents the relationship between mean state duration and cultural attitudes.
- Figure S3 presents the quadratic relationship between mean state duration and control levels for time periods 1-XXXX.

	(1) Trust	(2) Respect	(3) Control	(4) Obedience
Mean State Duration	2.232	0.113	3.215***	1.178
	(2.181)	(1.125)	(1.097)	(1.142)
Mean State Duration (Sq)	-4.894	-1.311	-5.975***	-0.642
	(4.218)	(2.239)	(2.260)	(2.285)
Agricultural Suitability	✓	✓	✓	✓
Elevation	✓	✓	✓	✓
Distance to Water	✓	✓	✓	✓
Agri Adoption	✓	✓	✓	✓
Distance to City	✓	✓	✓	✓
Latitude	✓	✓	✓	✓
Longitude	✓	✓	✓	✓
Lat*Lon	✓	✓	✓	✓
Country FE in Yr2000	✓	✓	✓	✓
Observations	445	445	445	445

Table S5: Mean State Duration on Cultural Attitudes. The outcome variables in the above models are level of trust, respect, control and obedience levels based on the 2010 European Social Survey. All models include country fixed effects in year 2000, and robust standard errors are shown in parenthesis. * $p<0.10$, ** $p<0.05$, *** $p<0.01$.

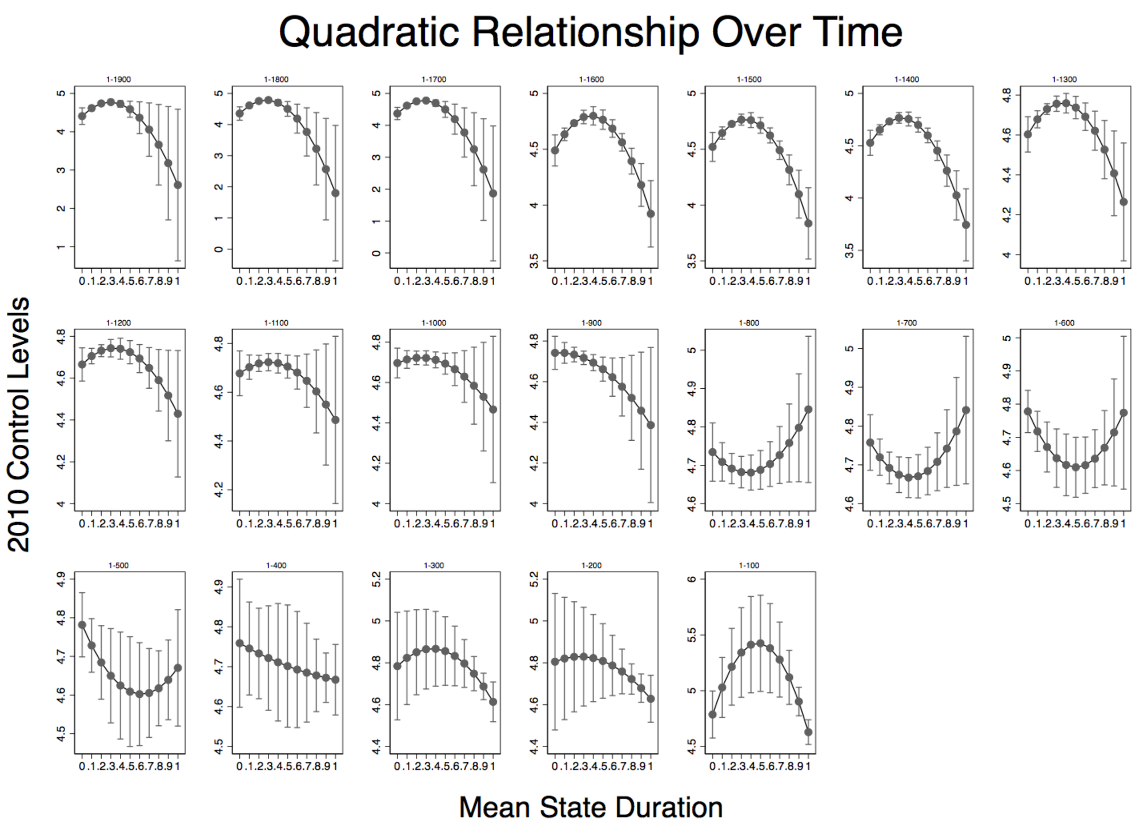

Figure S3: Quadratic Relationship between Mean State Duration and Control Levels for different time periods (1-XXXX).

Works Cited

Abadie, Alberto and Javier Gardeazabal (2003). "The Economic Costs of Conflict: A Case Study of the Basque country". In: *American Economic Review* 93.1, pp. 112–132.

Abramson, Scott F (2017). "The Economic Origins of the Territorial State". In: *International Organization* 71.1, pp. 97–130. DOI: 10.1017/S0020818316000308.

Akresh, Richard and Damien de Walque (2008). "Armed conflict and schooling: evidence from the 1994 Rwandan genocide". In: *Households in Conflict Network Working Paper*, p. 47. URL: http://www.hicn.org/wordpress/wp-content/uploads/2012/06/wp47.pdf.

Bavel, Bas van (2010). *Manors and Markets: Economy and Society in the Low Countries 500-1600*. Oxford University Press.

Besley, Timothy and Torsten Persson (2009). "The Origins of State Capacity: Property Rights, Taxation, and Politics". In: *American Economic Review* 99.4, pp. 1218–1244.

Blaydes, Lisa and Eric Chaney (2013). "The Feudal Revolution and Europe's Rise: Political Divergence of the Christian West and the Muslim World before 1500 CE". In: *American Political Science Review* 107.1, pp. 16–34.

Blaydes, Lisa and Christopher Paik (2016). "The Impact of Holy Land Crusades on State Formation: War Mobilization, Trade Integration, and Political Development in Medieval Europe". In: *International Organization* 70.3, pp. 551–586.

Bosker, E. Maarten, Eltjo Buringh, and Jan Luiten van Zanden (2013). "From Baghdad to London: Unraveling Urban Development in Europe, the Middle East, and North Africa, 800-1800". In: *Review of Economics and Statistics* 95.4, pp. 1418–1437.

Chamarbagwala, Rubiana and Hilcias E. Morán (2011). "The Human Capital Consequences of Civil War: Evidence from Guatemala". In: *Journal of Development Economics* 94, pp. 41–61.

Cox, Gary W., Douglass C. North, and Barry R. Weingast (2015). "The violence trap: A political-economic approach to the problems of development (Working Paper)". URL: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2370622.

Dincecco, Mark and Massimiliano Gaetano Onorato (2017a). *From Warfare to Wealth: The Military Origins of Urban Prosperity in Europe*. Cambridge University Press.

— (2017b). "Military Conflict and the Rise of Urban Europe". In: *Journal of Economic Growth*.

Duncan-Jones, R. (1982). *Economy of the Roman Empire*. Cambridge University Press.

Harish, S.P. (2015). "Intergenerational Effects of War: Evidence from Timor Leste (Working Paper)".

Mitchener, Kris James and Marc Weidenmier (2008). "Trade and empire". In: *The Economic Journal* 118.November, pp. 1805–1834.

Mokyr, Joel (1977). *Industrialization in the Low Countries, 1795-1850*. Yale University Press.

Nexon, Danel H. and Thomas Wright (2007). "What's at Stake in the American Empire Debate". In: *American Political Science Review* 101.2, 253271. DOI: 10.1017/S0003055407070220.

Pierskalla, J, A. Schultz, and E. Wibbels (forthcoming). "Order, Distance, and Local Development Over the Long-Run". In: *Quarterly Journal of Political Science*.

Pop-Eleches, Grigore (2007). "Historical Legacies and Post-Communist Regime Change". In: *Journal of Politics* 69.4, pp. 908–926.

Preacher, K.J. and A.F. Hayes (2008). "Asymptotic and Resampling Strategies for Assessing and Comparing Indirect Effects in Multiple Mediator Models". In: *Behavioral Research Methods* 40, pp. 879–891.

Rokkan, Stein (1975). "Cities and Economic Development: From the Dawn of History to the Present". In: *The Formation of National States in Western Europe*. Ed. by Charles Tilly. Princeton, NJ: Princeton University Press, 562600.

Stasavage, David (2010). "When Distance Mattered: Geographic Scale and the Development of European Representative Assemblies". In: *American Political Science Review* 104.4, pp. 625–643.

— (2014). "Was Weber Right? The Role of Urban Autonomy in Europe's Rise". In: *American Political Science Review*, pp. 1–18.

Temin, Peter (2006). "The Economy of the Early Roman Empire". In: *Journal of Economic Perspectives* 20.1, pp. 133–151.

Tilly, Charles, ed. (1975). *The Formation of National States in Western Europe*. Princeton University Press.