On the duration of empires

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ABSTRACT

Why did some empires endure for centuries whereas others quickly fade? To approach this question, I focus on geography, namely the extent to which an empire abutted a sea. Seas could have allowed for greater opportunities for integration as well as trade with external polities. I consider historical empires from antiquity until 1922 and examine whether those empires with larger coastlines relative to their areas endured longer. Using various estimation methodologies and instrumenting for the length of the coastline, I find support that empires that were more connected to seas lasted longer. Further analysis suggests that the potential for seaways to lead to greater integration provides a stronger explanation than the potential for seas to provide a defensive barrier.

1. Introduction

The question of "why Rome fell" has enticed historians for centuries. Edward Gibbon and Henri Pirenne are only two of the numerous scholars tackling this issue. Others such as Turchin (2003, 2006) have considered empires more generally and have tried to find common explanations for imperial decline. This paper takes a different perspective. Why did some empires persist for centuries whereas others fade quickly?

This paper considers one explanation, namely that greater access to the sea provided advantages promoting longevity. Such access could have led to greater economic and political integration, both internally and with outside polities. The focus on geography in determining long-run outcomes is congruent with Diamond (1997) who sees geography as benefitting Eurasian societies (relative to New World ones) due to an 'East-West' axis and the prevalence of animals that could be domesticated to become richer and more powerful than those in other regions. Turchin (2009) find that empires more often spread along an east-west (versus a north-south) axis since climate varied less along lines of latitude. Acemoglu et al. (2001) use settler mortality primarily driven by the disease environment in European colonies centuries ago to explain income differences in these former colonies today. Brückner and Ciccone (2011) use rainfall as an exogenous shock in examining to what extent income shocks can drive democratization, at least in poor, agricultural economies. More relevant to this paper, Schmitt (1943) cites Byzantium's long coastline as a key factor in its perseverance.

Pursuing this inquiry is important for at least two reasons. First and more specifically, several studies (see below) find that access to the sea (relative to being landlocked) provides benefits to modern economies. This examination looking at empires from centuries ago can better determine to what extent such adjacency was important historically when political structures, economies, and technologies greatly differed from today's counterparts. Second and more generally, many researchers forward conjectures as to what factors contributed to a particular empire's success and persistence. Perhaps such factors generalize. A finding that adjacency to the sea – and, geography, more broadly – generalizes would support examining more inclusive studies of empires such as in Turchin (2003) and

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Chase-Dunn and Hall (1997).

Of course, I do not want to overextend my inferences, either. My focus on empire duration implies nothing about empire formation and growth. Doyle (1986) discusses the growth of empires, attributing them to the dispositions within the core and the periphery as well as the relative strength between the two. I do not argue that empires beginning near the sea initially grew faster or expanded farther. The analysis takes as given the existence of a large territorial state and examines if access to seas contributed to its subsequent longevity. To take Rome as an example, interconnectedness by water could have provided the Romans an asset in maintaining their empire, but it does not explain why Rome succeeded over other Italian cities. Second, the relative advantages of waterways to transport goods and people and to convey information diminished as inventions such as the railway and telegraph lowered travel times over land. The presence of seaways to promote integration is likely less important today. Third, I do not claim that access to the sea was the only factor in promoting longevity. Governing institutions were also important, especially following the death of a charismatic leader. Burbank and Cooper (2010) provide a survey of important empires, demonstrating how the core through cultural or social inclusion could maintain durability.

Finally, the focus on adjacency to the sea does not put forth a new theory or perspective. Many have described historical advantages of water transport. The presence of strong links between the core and periphery of an empire appears to be a straightforward factor for cohesion. The potential for trade to create wealth that can then strengthen a polity is also not a new view. Therefore, instead of considering a new view this paper examines whether the benefits of adjacency to the sea provided meaningful benefits whose advantages are detectable given the myriad of other factors – both exogenous shocks and structural characteristics – in contributing to longevity.

The remainder of the paper proceeds as follows. Section 2 provides an overview as to why seas could promote imperial longevity through integration. Section 3 describes the data and empirical specification. Section 4 discusses results. Section 5 considers an alternative reason why seas could have been beneficial for imperial longevity, namely by providing a defensive barrier against invaders. Section 6 offers conclusions.

2. Background

This section provides context as to how waterways could influence empire duration, comparing theoretical arguments that impinge on this topic.

Consider a core (C) and a periphery (P). C controls P (either directly or indirectly through local leaders) and channels resources to and from P. The empire endures as long as C maintains control over P. Therefore, empires that establish stronger links between C and P can endure longer as negative shocks would need to be greater in magnitude – and, thus, would presumably be less frequent – for the empire to fall.

This view is a simplification of Motyl (2001) whose focus of imperial decline also takes the existence of a large territorial state as a starting point with both C and P regions. Decay within an empire occurs due to some structural contradiction leading to conflict over resources among opposing interests. These conflicting parties could consist of tensions among different regions within the empire or due to competing interests within the core. Motyl cites the increasing budgetary needs of the Byzantine Empire to feed the bureaucracy as well as tensions between the eunuchs and emperor in Han Dynasty that diminished the power of the core, leading to the Yellow Turban Rebellion when the central government could not address an agrarian crisis. These conflicts weaken linkages between C and P. Eventually, enough links are broken to cause the death of the empire although circumstances particular to the empire could determine if this death is gradual, disassembling over a long period of time, or sudden. Although the empire eventually succumbs, Moytl explains why this process of decay could slow in some cases, namely "in particular, increased production… could meet the growing resource requirements of the core state" (p. 64) thereby delaying imperial decline as competing interests are mollified.

I depart from Motyl (2001) in two important ways. First, Motyl envisions a P–C–P system where the empire has at least two peripheries. However, the peripheries neither interact with one another (and so this second part of the characterization requires more than one periphery to exist) nor independently with outside polities. The image Motyl presents is a wheel with a hub (the core) and spokes to the peripheries but no rim connecting the peripheries directly to one another. My approach does not require multiple peripheries lacking a rim. As long as the core maintains control over the peripheries then whether the peripheries interact with one another is less relevant. Second, Motyl cites the importance of an empire's ability to amass wealth for its duration but does not delve into specific factors that could promote wealth creation. Instead, I take sea trade as an important source of wealth creation that can promote maintenance of the empire. Therefore, seas not only create stronger links between C and P but also generate wealth that allows C to better maintain control of P. The greater ability to generate wealth comes not only from greater internal trade but from greater trade opportunities with those outside the empire.

Trade via water transport has often been viewed as conducive to economic activity. Paine (2013) argues that "Rome's growth and prosperity was inextricably tied to its control of the Mediterranean's sea-lanes" (p. 107). The great difficulties and high costs of building canals also imply huge benefits of water transport. An early example comes from China with the Grand Canal, built around 600C.E. but then later extended by subsequent dynasties. Many of China's rivers such as the Yangtze and Yellow primarily run east to west. The north-south canal linked these river systems and promoted the flow of goods, especially food from the southern provinces to the capital. Towns and so economic activity subsequently arose along the canal to take advantage of the increased opportunities for trade. Paine (2013) also describes how seas could have facilitated trade around the rim of an empire such as along China's coast or to circumvent mountains, swamps, and jungles that lay along many Asian coastlines.

Seaways could have also created greater integration with trade routes outside the empire such as the Spice Route linking East and Southeast Asia to India and, subsequently, to the Persian Gulf and Red Sea. Paine (2013) describes how Alexandria prospered as an

entrepôt, connecting maritime trade between the Indian Ocean, the Red Sea, and (except for a short trek over land) the Mediterranean. Extensive links also existed between China and the Indian Ocean. Upon conquering the Song Dynasty, Kublai Khan (a Mongol from the steppes) built thousands of ships at great expense to take further advantage of maritime commerce. Marco Polo described the port city of Hangzhou and the riches that arose due to trade.

These views mirror analogous claims of access to the sea during modern times. Gallup et al. (1999) find that coastal countries are richer than landlocked ones and speculate that seas provide for greater economic integration with other regions. Collier et al. (1999) consider Africa's many landlocked countries and greater fraction of people living far from seas and navigable rivers as one potential reason for Africa's poverty (although they acknowledge that landlocked countries within rich regions might not face the same disadvantages since they can trade with neighbors). Rappaport and Sachs (2003) document higher productivity for coastal regions in the U.S. and speculate lower transportation costs as a reason.[1] Mellinger et al. (2000) also consider proximity to seas as an important geographic benefit. If similar effects held in the past, then more sea-based empires would have been richer than those with less access to seas.

The above discussion posits that greater economic integration, both internally and with external polities, would have increased income thereby allowing for greater imperial longevity. This view contrasts with Alesina and Spolaore (1997) and Bolton et al. (1996) for whom greater economic integration lowers border costs and so provides incentives for communities within a polity to secede. Although these models are static, they imply that polities would more quickly disassemble if agents have more incentive to secede. However, Doyle (1986) cites trading opportunities for merchants in the periphery of an empire as lessening desires for the periphery to secede. In this view, agents would be less likely to secede if secession would sever trade links. Mitchener and Weidenmier (2008) find that regions within an empire traded more extensively than ones outside of it during the Age of High Imperialism from 1870 to 1913. Moreover, increased trade increases output and tax revenues. This potential for more revenue might not only provide incentives for leaders to spend resources to maintain the empire but also provide the means for doing so. Collins (1999), Kennedy (1987), and Khaldûn and Rosenthal (1967) see fiscal deficiencies as key reasons for empires to fall.

The above discussion sees seaways as generating wealth which could then strengthen links between the core and periphery. Seas could have also directly reinforced these links through other types of integration. Water transport could have facilitated military and political integration that could have also strengthened the spokes between core and periphery. A second purpose of the Grand Canal was to transport soldiers to and from northern China. The ability to more quickly move military forces to where they are needed would not only have made conquering the empire from outside more difficult but would have lowered the potential for local leaders to attempt to secede. Political integration could have also been enhanced. Upon completion, Emperor Yang traveled along the Grand Canal to visit southern provinces and so to more thoroughly project his authority. Roman emperors from Augustus to Hadrian were able to travel extensively throughout the empire and so were able to maintain some presence even in distant provinces despite the difficulties described in Heather (2005). Water travel could have diminished the authority of governors because they operated under less autonomy, making them less able to secede.

Social integration could have also been important. Turchin (2003) emphasizes the role of collective solidarity in first creating and then maintaining an empire as larger groups can more effectively wield power as long as they share common interests. However, Turchin questions whether seas can enhance collective solidarity by facilitating travel within an empire or diminish it as seas separate different components of the empire. Findings here can speak to this ambiguity.

In summary, seaways strengthen the spokes of the wheel by creating greater integration promoting strength and longevity. They also increase the potential for trade, both internally and externally, thereby increasing income and the ability of the core to maintain control. Such links eventually break as at some point a large enough exogenous shock (or series of shocks) hits to bring down the empire. Nevertheless, such sufficiently large shocks presumably take longer to occur thereby lengthening the empire's longevity.

3. Sample and empirical model

Part A provides the criteria for which empires comprise the sample. Part B presents the empirical models. Part C discusses the data and part D addresses weaknesses of the methodology.

3.1. Sample of empires

Table 1 lists 69 empires, 58 of which reached at least 1 million km^2 comprising the main sample. The appendix contains a brief description of each empire. These empires come from Taagepera (1978a, 1978b, 1979, and 1997) with some caveats described below. I consider those from Taagepera so as to consider a sample formed externally to this project.[2]

I focus on empires from Eurasia and Africa that remained in the Old World. I do not consider New World empires or Pacific empires as greater uncertainty arises as to their history and origins. Second, the declines of the Incas and Aztecs both occurred due to European expansion into the New World. Given European military advantages and the diseases borne by Europeans (see Diamond, 1997), their fall was virtually certain. Moreover, they had previously no contact with Eurasia prior to 1492 and so fell outside the "world system". This isolation also distinguishes the New World from polities in sub-Saharan Africa that had trading links to Eurasia and so are included

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[1] However, Nunn and Puga (2012) find that proximity to the sea in Africa hindered development since such proximity more greatly facilitated the slave trade.

[2] Nevertheless, the lack of historical records has limited the number of African observations in the sample.

Table 1
Sample of empires.

# Name	One million km² Threshold			500,000 km² Threshold			
	BEGIN (year)	COAST (km	SIZE (km²)	DUR (# of years)	BEGIN (year)	COAST (km)	SIZE (km²)
1 Almohad	1145	4601	2.3	103	1145	4601	2.3
2 Almoravid	1055	1760	2	92	1055	1760	2
3 Archaemenid	−550	2837	2.5	220	−550	2837	2.5
4 Avars	568	700	1	62	568	700	1
5 Bactria	−200	0	1.8	75	−270	0	0.7
6 Buyid				93	937	1020	0.75
7 Carolingian	793	1542	1	50	508	1530	0.5
8 Chagatai	1260	0	3.5	103	1260	0	3.5
9 Chu				111	−334	1137	0.5
10 Cordoba				254	756	2300	0.5
11 Delhi Sultanate	1233	650	1	165	1206	0	0.5
12 Earlier Zhao	304	0	2	25	304	0	2
13 Eastern Wei				43	534	1868	0.8
14 Egypt (26th Dynasty)				130	−655	2450	0.5
15 Egypt (New Empire)	−1450	4118	1	373	−1500	2560	0.65
16 Fatimid/Ayyubid/Mamluk	969	6800	1.5	556	961	4016	0.65
17 Ghaznavid	1000	590	1.3	173	1000	590	1.3
18 Gokturk	552	1326	5	78	552	1326	5
19 Golden Horde	1259	5417	6	179	1259	5417	6
20 Gupta	374	1230	1.2	156	366	400	0.7
21 Gurjara Pratihara	857	1000	1	53	775	1000	0.5
22 Han	−204	2200	1.4	424	−205	1250	0.8
23 Harsha	618	1228	1	29	618	1228	1
24 Hunnic	370	2470	2.5	99	370	2470	2.5
25 Ilkhanate	1256	4213	3.4	79	1256	4213	3.4
26 Jin-Later Tang-Later Jin				40	907	1124	0.8
27 Jinn	1125	1950	1.3	109	1118	1511	0.7
28 Kara Khitan	1130	0	1	88	1130	0	1
29 Khazar	800	2400	1.2	169	671	1830	0.6
30 Khmer				405	945	2500	0.7
31 Khwarezmid	1195	2274	1.5	25	1195	2274	1.5
32 Kiev	987	300	1.2	145	888	300	0.65
33 Kushan	36	516	2	194	30	0	0.8
34 Liao	930	2638	1	195	918	1110	0.5
35 Mali	1291	877	1	254	1268	148	0.5
36 Maurya	−321	2290	1.4	180	−321	2290	1.4
37 Median	−614	1645	1.4	64	−614	1645	1.4
38 Ming	1368	4348	3.1	276	1368	4348	3.1
39 Mongol	1206	0	4	162	1206	0	4
40 Mughal	1566	447	1	171	1556	0	0.5
41 NeoAssyrian	−673	1720	1	65	−708	1720	0.5
42 Northern Wei	471	1868	1.4	63	436	707	0.8
43 Ottoman	1516	11,270	1.35	406	1400	4210	0.5
44 Parthian	−145	2170	1	372	−145	2170	1
45 Ptolemaic	−305	4665	1	275	−305	4665	1
46 Qin				34	−240	0	0.5
47 Qing	1644	4945	3.4	268	1626	2270	1
48 Rome/Byzantium	−133	14,565	1.05	1337	−200	6737	0.5
49 Rouran	402	0	2.8	150	402	0	2.8
50 Saffarid	873	1450	1.4	28	873	1450	1.4
51 Samanid	901	1590	1.4	98	901	1590	1.4
52 Sassanid	229	3667	2.3	422	229	3667	2.3
53 Seleucid	−311	1928	1.6	182	−311	1925	1.6
54 Seljuk	1043	1370	1.4	151	1041	550	0.9
55 Shu	221	0	1	42	221	0	1
56 Song (Later Han – Song)	959	1800	1.4	320	947	1150	0.7
57 Songhai				112	1479	0	0.5
58 Tang	623	5365	2.5	281	620	50	0.6
59 Tibet	618	0	2.8	224	618	0	2.8
60 Timurid	1382	1635	1.5	125	1371	0	0.6
61 Umayyad/Abbasid	634	6551	2.1	304	634	6551	2.1
62 Uyghur	744	0	3.1	96	744	0	3.1
63 Visigoth Kingdom				231	480	2850	0.6
64 Wei thru Chen	220	1660	1	369	220	1660	1
65 Western Turks	584	1760	3.5	73	584	1760	3.5
66 Western Wei thru Sui	578	1666	1.5	40	534	0	0.5
67 Western Zhou				275	−1046	1347	0.55

Table 1 (*continued*)

# Name	One million km^2 Threshold			500,000 km^2 Threshold			
	BEGIN (year)	*COAST (km*	*SIZE (km^2)*	*DUR (# of years)*	*BEGIN (year)*	*COAST (km)*	*SIZE (km^2)*
68 Wu	220	3300	1.5	60	220	3300	1.5
69 Xiongnu	−209	0	2.5	294	−209	0	2.5

Negative values for *Begin* denote BCE. To determine the duration for the 500,000 km^2, add the difference (if any) in beginning dates for the two thresholds to *DUR*.

in the sample[3]. Many of the Pacific empires were territorially small (in land area) and so would not be included in the sample anyway.

I also remove the European overseas empires such as the British and Spanish colonial empires. These colonial empires arose due to superior technology and the spread of disease. Instead, I consider empires that remained in the eastern hemisphere. However, the inclusion of colonial empires would only strengthen findings given that many of these seaborne empires lasted for centuries. By removing New World empires as well as the European overseas empires, I restrict the sample to a closed system of Asia-Africa-Europe.

The sample includes empires that reached one million square kilometers in size since the paper's key question concerns the ability of waterways to facilitate governance of large territories. However, I will also add eleven empires reaching 500,000 square kilometers to the original 58 as a robustness check. I also only include those empires spanning more than a quarter century, providing enough time for governance to occur.

The sample begins with the formation of Egypt's New Kingdom in 1450 BCE and ends with the partition of the Ottoman Empire in 1922. By this time, modern technology was lessening distinctions between land and sea travel. Robustness checks will consider other possible beginning and ending dates for the sample.

Finally, I acknowledge that I use the term "empire" loosely and under some definitions, incorrectly. For some, such a term evokes images of autocracy. Others see the subjugation of "other peoples". Doyle (1986) defines "empire" as the political control imposed by one society over the effective sovereignty of *another society*. Maier (2006) also relies on the control of other polities as a key characteristic of empire. The focus, however, of this paper is on large political entities regardless of whether or not they control other distinct peoples. "Large" is important because distances in a small polity such as a Greek city-state are not expansive enough to deter integration within the polity. However, the concern as to whether this political entity commands a single, unified nation of people or multiple, distinct societies is less relevant for my application.[3] In this sense, my definition of "empire" corresponds to that given in Taagepera (1979): a sovereign entity whose components are not sovereign.

Furthermore, the extent the governing edifice exhibited democratic or autocratic characteristics is less relevant for this examination. For example, the Roman Empire traditionally began with Augustus but I set the beginning date of the Roman "Empire" 200 years earlier when the Roman Republic became the ruler of a large territory. Again, the focus is on polities territorially large, not on the governing institutions of those polities.

3.2. Empirical specification

Consider the specification:

$$DUR_i = COAST_i^\tau BEGIN_i^\omega SIZE_i^\theta \exp\left(\pi + \sum_{j=1}^{J} B_j REG_{ji}\right)\mu_i \qquad (1)$$

where i denotes the empire. After linearizing by taking natural logs:

$$\ln(DUR_i) = \pi + \tau * \ln(COAST_i) + \omega * \ln(BEGIN_i) + \theta * \ln(SIZE_i) + \sum_j \beta_{j*} REG_{ij} + \upsilon_i$$

where $\upsilon_i = \ln(\mu_i)$ \qquad (2)

DUR denotes the empire's duration in years. *COAST* denotes a measure of an empire's coastline relative to its total area and will be further discussed below. *BEGIN* denotes the initial year of an empire's existence. To avoid negative values for years before year zero of the Common Era, I renormalize so that year zero of the Common Era is year 3000. This renormalization allows one to take natural logs. I add 3000 since many consider the Akkadian Empire to be the world's first empire, beginning in 2686 B.C.E. (although the Akkadian Empire is not large enough to be used within the sample).

I include *BEGIN* since Taagepera (1978a) finds that later empires tended to be larger. One reason is technological. Inventions like the stirrup enhanced the power of mounted soldiers which could have influenced the durability of empires. Allen (2005) discusses bureaucratic advances that also led to better governance of expanded territories. Using Assyria as an example, he lists increased standardization and monetarization, a *lingua franca*, and greater reliance on vassals as opposed to direct control as key developments in allowing empires to become larger. Such practices became more common over time. On the other hand, early empires like those of

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[3] Of course, such distinctions could certainly influence an empire's power. Empires containing a more unified, homogenous population could be inherently stronger than a polyglot.

Egypt were often more isolated and so less exposed to attack thereby further contributing to their duration.

SIZE denotes the empire's land area in squared kilometers when the empire first exceeded one million square kilometers. The initial size could exceed the one million km^2 threshold for three reasons. First, conquests within a year could take the empire from below one million square kilometers at the beginning of the year to over one million by year's end. Second, some empires seceded from others and so begin with larger territories. Finally, some confederations united to form an empire with an initial size above the threshold. I allow size to potentially influence durability although it is unclear as to what sign the coefficient on *SIZE* will take. Presumably, larger entities are more difficult to govern and could even be overextended, thereby suggesting a negative coefficient. However, more powerful empires should more greatly expand and so *SIZE* could actually be capturing the inherent power of the empire relative to its neighbors'. If the latter effect dominates, then the coefficient on ln(*SIZE*) should be positive.[4]

Several regional dummies, denoted by *REG*, will later be included since differences in other geographic features, demographics or culture could influence the durability of empires.[5] These regional dummies are: *CHINA*, Southeast Asia (*SEASIA*), *INDIA*, the Euro-Asian steppe (*STEPPE*), the Iranian Plateau (*IRAN*), the Middle East (*MIDEAST*), *EGYPT*, Sub-Saharan Africa (*SSA*), and Northern Europe (*NEUR*). The control group is the Mediterranean region (*MED*) excluding Egypt. An observation belongs in region *X* if it begins in region *X*. For example, *IRAN* equals one for Achaemenid Persia whereas *EGYPT* and *MIDEAST* equal zero even though Persia conquered the latter two regions. I focus on initial location since this is generally from where governance stems.

An advantage of using a log-log specification in (2) is that coefficients can be interpreted as elasticities, thereby facilitating inferences. Another advantage is to lessen the weight given to outliers. A drawback, however, is that one is finding the expected conditional mean of ln(*DUR*) and not the expected conditional mean of *DUR*, the latter being more relevant. Silva and Tenreyro (2006) also explain that log-linearizing an equation such as: $DUR = X^\beta \mu$ so as to become $\ln(DUR) = \beta\ln(X) + \upsilon$ where $\upsilon = \ln(\mu)$ could lead to inconsistent estimates. The reason is that if heteroskedasticity arises so that the variance of μ depends upon X then transforming the error term into its natural log will cause a nonzero correlation between υ and ln(*X*). In my application, such a problem could arise if the variance of the residual differs across regions or time or between small and large empires.

To address these concerns, they propose a Poisson Pseudo Maximum Likelihood [PPML] estimation methodology where the dependent variable is measured in levels. In a poisson distribution, the mean equals the variance. However, Silva and Tenreyro (2006) show that this requirement of equidispersion is not necessary to apply the PPML estimator. Instead, the conditional mean needs only be proportional to the conditional variance. Even if it is not, the PPML estimator is still consistent. Given the familiarity of the linear model in (2) but also given the above discussion, I utilize both estimation techniques: OLS and PPML.

3.3. Data

Data for *BEGIN*, *DUR*, and *SIZE* comes from numerous sources including Taagepera (1978a, 1978b, 1979, and 1997), Turchin et al. (2006), and the *Encyclopedia Britannica*. Taagepera calculated growth-decline curves where he estimated the sizes of large political units at various points in time, calculating such areas on a map from historical accounts of imperial expansion and decline. Descriptive statistics are provided in Tables 1 and 2.

Estimates for *BEGIN* and *DUR* also come from Taagepera's work along with other sources such as the *Encyclopedia Brittanica.* To determine *BEGIN*, I take the year when the empire first reached (or exceeded) one million km. As discussed above, the focus of this study is the longevity of existing empires. Considering how small polities become large ones is an interesting issue but beyond the scope of this work.

For the end of empires, I do not necessarily use the traditional date to denote the fall. For example, the Ottomans conquered Constantinople in 1453, the year many mark as the end of the Byzantine Empire. However, Crusaders sacked Constantinople in 1204. The Byzantines regained power in 1261 but their subsequent territory barely exceeded the Theodosian Walls surrounding the city. Consequently, I choose 1204 as its ending date. When setting these end dates, I have tried to choose dates as critically as possible, using shorter durations for observations with more access to the sea (especially when trimming the Byzantine Empire by 249 years) so as to skew results against the importance of waterways.

A special case involves China. Often, the overthrow of one dynasty occurred through something akin to a "palace" coup. A powerful aristocrat within the imperial court would overthrow the emperor and declare a new dynasty. In some cases, this aristocrat was even the power behind the throne in the former dynasty. To make my sample more comparable across cases, I combine these different dynasties into one empire. After all, Roman emperors were often overthrown by internal rivals but historians do not see these coups as creating distinct empires. Only when a dynasty was toppled by an external power or that it fractured into several parts do I consider it the end of the empire.

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[4] One could presumably also measure size by population. However, population estimates for ancient empires are often not available and often differ more than area estimates. Take Achaemenid Persia as an example. McEvedy and Jones (1978) provide an estimate of 17.5 million. Yarshater (1996) gives a figure of 50 million, almost three times larger.

[5] Of course, I acknowledge that important geographic differences could also arise within empires which the regional dummies listed above are too coarse to capture. Moreover, empires at different locations within these regions could still face different geographies.

Table 2

Summary statistics.

Panel A: Descriptive Statistics				
	Levels		Natural Logs	
	Mean	Std. Dev.	Mean	Std. Dev.
DUR (in years)	193	195	4.92	0.84
SIZE (square km)	1.88	1.07	0.51	0.48
BEGIN (year)	569	640	8.16	0.20
COAST (km/km^2)	2367	2666	5.82	3.14
Panel B: Correlations (Variables expressed as natural logs)				
	SIZE		*BEGIN*	*COAST*
DUR	0.05		−0.05	0.18
SIZE			0.17	−0.17
BEGIN				−0.10

I construct *COAST* to equal the coastal distance of the empire divided by its area, both measured when the empire first reached or exceeded the one million km^2 threshold.[6] Once empires reached this one million km^2 threshold, did the degree of adjacency to the sea then contribute to longer subsequent duration? For the Tibetan Empire, *COAST* equals zero since this empire had no coastline. For Rome, the ratio is large given that Roman territory abutted much of the Mediterranean while also running along part of the Atlantic Ocean. Other empires with large values for *COAST* are those that narrowly ran along a sea or ocean. The lack of width produces a small area whereas a long coastline gives a large numerator. As the empire spreads further inland and increases its area, the potential for a sea to integrate the empire diminishes. Obviously, not all parts of a coastline are conducive to acting as a port or facilitating traffic. Nevertheless, I presume that such features are positively correlated with the length of the coastline.[7]

Fig. 1 plots *COAST* versus *DUR*, zooming in on the non-landlocked observations (since *COAST* = 0 for the landlocked ones). One sees a positive association between the two with Rome-Byzantium, the Ottomans, and the Fatamids-Mamluks providing the three longest lasting empires and the ones with the three largest values of *COAST*. All three would have taken advantage of the Mediterranean providing internal water links. An outlier on the other side of Fig. 1 is Kiev with the lowest value of *COAST* for a non-landlocked empire but one that still endured for 145 years. Despite little adjacency to the sea, Kiev still conducted extensive trade along rivers. Table 1 also lists the landlocked empires. The longest lasting of these was the Xiongnu Empire (294 years), likely benefitting from only facing China to the south and its ability to retreat into the steppe when China sent armies north. The Mongols and Rouran enjoyed similar advantages. Moreover, the Mongol Empire did not remain landlocked. Tibet was the second longest-lasting landlocked empire and certainly benefitted from being situated on the defensible Tibetan Plateau.

3.4. Weaknesses

Measurement error is nontrivial, especially given that taking the ratio of coastline to area is not driven by any formal theory. Nevertheless, to the extent that this measurement error is noise and so uncorrelated with right hand side variables then coefficients in least squares regressions are biased toward zero, making significant associations more difficult to obtain.

Second, many aspects of empires that could have contributed to longevity are not included in the model. Differing institutional hierarchies and political mechanisms could have mattered for how successful a central government was in projecting authority across space. The confederation of formerly distinct groups versus a highly bureaucratic polity such as the Roman Empire are two examples of these extremes. Moreover, infrastructure such as the existence of a "Royal Road" could have facilitated the governance of remote areas. The degree of ethnic diversity is another characteristic that could have influenced longevity although whether such diversity hinders governance due to lesser commonality across subjects or promotes it due to a "divide and conquer" approach remains uncertain. I acknowledge that all of these factors could have mattered for longevity. However, I find it less clear that they are associated with *COAST* and so biasing its coefficient. In addition, since the coefficient on ln(*COAST*) is positive (as shown below) such factors must be positively associated with both longevity and access to the sea for the below results to overstate the importance of seas. A third condition is that any such factors cannot themselves be determined by access to the sea since then they would merely become a channel as to how seas could have benefitted imperial longevity.

Third, biases could arise in how *COAST* is determined. More powerful empires – and so presumably more durable ones – would more likely stretch until they reached a coast thereby creating a long coastline. In this case, a long coastline does not help to propagate

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[6] The coastal paradox states that the landmass of a coast has no well-defined length given the fractal properties of coastlines. The measured length of a coastline increases as one "zooms in". See Mandelbrot (1983). Nevertheless, what matters for the purposes of this analysis is not perfect measures but consistent measures across observations. Therefore, I measure coastline using Google Earth with a camera 4000 km in altitude for all observations.

[7] Rivers could also potentially lead to greater integration or to a better defense and some empires such as early Egyptian ones and Mesopotamian ones spanned rivers or river systems. Nevertheless, in separate regressions, I did not find any evidence that empires primarily stretched along such a river system endured longer. The lack of stronger findings could be a sign that rivers were less important for integration than seaways. Or, the lack of stronger findings could simply be due to even less precision in trying to measure to what extent an empire "spanned" a river.
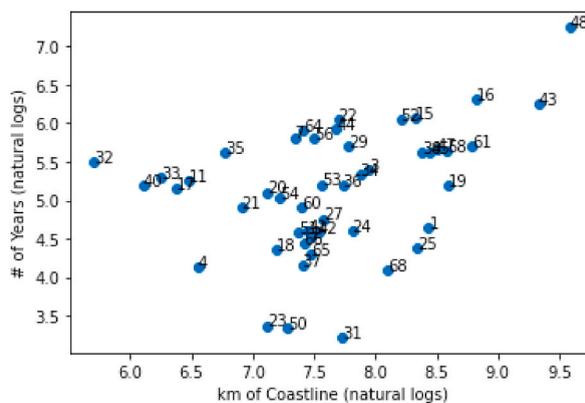
Fig. 1. Length of coastline and duration.

an empire but is a sign of some other underlying strength. The inclusion of *SIZE*, however, can mitigate this concern. Moreover, considering the coastline-area ratio at the time the empire first satisfied the one million km^2 threshold helps ensure that causality runs from *COAST* to *DUR*. Even if coastline then continued to expand as the empire grew and persisted, this additional coastline does not increase the value of *COAST* used in the methodology.

However, endogeneity concerns remain. If only powerful empires could project power across water to some opposite shore thereby increasing a coastline, then the coefficient on ln(*COAST*) could be biased upwards. Moreover, denote the year in which the one million km^2 threshold is satisfied as T. If factors not included in (1) predating T promoted an empire's expansion and so thereby increased coastline and if these same factors contribute to longevity after T, then these omitted variables could bias the coefficient on *COAST*.

One way to address these endogeneity concerns is to instrument for *COAST*. I use the shortest distance from the initial locus of power (usually a capital city) of an empire to the sea as an instrument for *COAST*. The presumption is that this initial proximity to the sea should be correlated with the extent of coastline an empire could obtain but that this proximity at an empire's *inception* should not be correlated with unobservable factors such as an empire's institutions or the abilities of its leaders that determine an empire's power. To consider potential nonlinearities and threshold effects, I not only use the shortest distance in kilometers from the initial locus of power to the sea but its natural log and a dummy that equals one if this initial locus of power is on the coast. Since some capitals lie on the coast, I add one to this distance so as not to remove the observations. The use of multiple measures also allows for overidentification tests.

Finally, the small sample size tempers results. Only 58 empires comprise the 1+ million km^2 sample whereas just 69 make up the 500,000+ km^2 sample. These small sample sizes stem from many of the restrictions described above, restrictions that provide for more apples-to-apples comparisons. Of course, the small sample size means that results are more susceptible to outliers although robustness checks will better ensure that any one observation is not driving results. A related issue concerns to what extent findings apply to these excluded empires.

4. Results

Table 3 presents results from the four estimation methodologies: the log-linear regression model in (2), PPML estimation from (1), and their respective instrumental variable estimations. Results are generally consistent across models although stronger for the IV methodologies. Given concerns regarding endogeneity, I focus on the results from columns (3) and (4). First considering the controls, earlier empires were longer lasting as indicated by the negative coefficients on ln(*BEGIN*). This result could have arisen because earlier empires were more isolated geographically and so faced fewer challengers. The coefficient on ln(*SIZE*) is positive although generally not statistically significant.

Across all specifications, results for *COAST* indicate that empires that had greater coastlines relative to their size persisted longer. The coefficient from column one suggests that a one standard deviation in ln(*COAST*) is associated with an increase of ln(*DUR*) of just over a fourth of a standard deviation. The IV estimate in column three suggests an impact of just over two-thirds of a standard deviation for ln(*DUR*). This seems plausible in that the association is not trivial but other factors were presumably of importance as well. The discussion of section 3 suggested that the OLS coefficient estimate for ln(*COAST*) could be biased upwards as longer lasting empires would have had more time to reach coasts. However, the estimate from column three is greater in magnitude (suggesting that the OLS estimate is biased downwards) than its counterpart in column one. One explanation for the smaller OLS estimate is that nonsystematic measurement error biases the OLS coefficient to zero, and this measurement error bias dominates any bias from latent factors contributing to both longevity and the ability to reach a coastline. Results using PPML without and with instruments are qualitatively similar.

As for various diagnostic checks across the specifications, the R^2 of the OLS model is 0.10, relatively high considering the simplicity of the empirical model, the certainly large amount of measurement error in these variables, and idiosyncrasies for why empires fell. The diagnostic checks for the IV model suggest that the model performs reasonably well. The null that the model is underidentified is

Table 3
Baseline results.

	(1) OLS	(2) PPML	(3) IV – 2SLS	(4) IV - PPML
Dep. Variable	Ln(*DUR*)	*DUR*	Ln(*DUR*)	*DUR*
Ln(COAST)	0.074** (0.034)	0.119* (0.062)	0.192*** (0.073)	0.204*** (0.064)
Ln(BEGIN)	−0.729 (0.477)	−0.771** (0.350)	−0.724 (0.486)	−0.936 (0.506)
Ln(SIZE)	0.108 (0.084)	0.022 (0.066)	0.217* (0.123)	0.158 (0.114)
Constant	10.232** (3.895)	10.749*** (2.862)	9.297** (3.969)	11.326*** (4.130)
# of obs	58	58	58	58
R^2	0.099	0.165		

Standard Errors in Parentheses. ** and *** denote significance at the 5%, and 1% levels.

rejected at the 1% significance level whereas the p-value from the Hansen J-statistic is 0.09 and so does not reach the conventional 5% threshold. The Kleibergen-Paap Wald F-Statistic is 13.2 and so does not provide strong evidence that instruments are weak.

Table 4 presents a battery of robustness checks. All specifications include the same control variables as given in Table 3 but only the coefficient estimates for ln(*COAST*) are presented. Row 1 includes regional dummies as outlined above. The coefficient on ln(*COAST*) decreases but only slightly.

Rows 2 through 11 go back to the simpler model (without regional dummies) but each row removes one of the ten regions from the sample. These removals are important for two reasons. First, the introduction motivated the paper by citing Rome's longevity. Other Mediterranean empires such as the Ottoman Empire also endured for centuries. However, as shown in row 11 the importance of coastlines applies outside the Mediterranean region as well. Second, since every empire is removed at some point in these ten robustness checks, no one empire solely drives the findings of the paper. Taking rows one through eleven of Table 4 together, all results in the IV estimations remain robust – both in terms of statistical significance and in terms of the magnitude of the coefficient estimate – to controlling for geographic region as well as to individually removing each region. However, the removal of China is more important for the OLS and PPML estimations.

Rows 12 and 13 only include empires that lasted over 49 and 99 years, respectively. I consider different minimum durations for several reasons. Most simply, results remain robust to using a different threshold than 24 years. Second, one could argue that these longer lasting empires are more important historically. Finally, the above results could be driven by the benefits of waterways to achieve some initial success but then have a reduced marginal effect on subsequent duration. Therefore, restricting the sample to those empires that achieved some minimal duration can better isolate longer-run associations from any initial benefits. Of course, any specific minimum such as 50 years is arbitrary; but considering empires that lasted for at least a half century considers a sample in which all observations showed at least a modicum of promise for continued survival. Using a minimum of one century considers empires with substantial potential for survival. Not surprisingly, the coefficients fall in magnitude since these robustness checks reduce the variation of the dependent variable. Nevertheless, the coefficient on ln(*COAST*) remains significant. Row 14 removes the Rome/ Byzantium observation since it is the only one spanning 1000 years.[8]

Rows 15 and 16 limit the sample to those empires that began after 600 BCE or ended before 1648 CE, respectively. Less is known about empires before 600 BCE and so removing them creates a sample where one can be more confident about dates and the territorial extent of the empire. Moreover, the oldest empires could have come into less conflict due to the fact that empires did not border one another as often thereby better avoiding conflict. Turning to a ending terminal, many cite the Treaty of Westphalia as the birth of the modern nation-state. Removing observations stretching beyond 1648 removes more "modern" observations. The coefficient on ln (*COAST*) falls somewhat in magnitude when latter empires are removed but remains significant.

Row 17 removes the empires with no coastline and results greatly strengthen. Fig. 2 (where the fitted line shows the predicted value of ln(*DUR*) **after** removing the landlocked empires) shows why, namely a discrete jump to the right in the distribution of *COAST* after zero. Some empires are landlocked, but no observation has a "tiny" coastline just above zero. When the empires with no coastline are included in the regression, the presence of this discrete jump weakens the association between ln(*COAST*) and ln(*DUR*). Table 1 identifies the ten landlocked empires (using the one million km^2 threshold) with varied lengths of duration. Four (Eastern Zhao, Kara Khitan, Shu, and Uyghur) lasted less than a century. The Mongol Empire eventually reached the sea and so did not remain landless for much of its 162-year duration. Bactria (145 years) and Tibet (224 years) were both located in mountain terrain, providing a defensive barrier.

In all of these robustness checks, the findings for these changes to the sample do not obviate the results from Table 3. The association between empire duration and its initial geography regarding its coastline relative to its total area remains robust. Moreover, the coefficients on *COAST* generally remain stable.

Table 5 considers the same regression but uses an initial threshold of 500,000 km^2 for an empire to enter the sample, thereby expanding the set of empires in the sample (since some empires that reached 500 k never grew to one million km^2 in size). Admittedly, the one-million km^2 threshold his arbitrary. I do not consider smaller thresholds since a key argument is that seas helped to integrate

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[8] Setting 410 CE as the end of the Roman Empire and so including separate Roman and Byzantium observations strengthens results. Although combining the two provides for a longer value of duration (by construction), including an additional long-lasting empire with a long coastline strengthens results even more.

Table 4

Robustness checks: Coefficient estimates for *COAST*.

Row	Dep. Variable	(1) OLS Ln(*DUR*)	(2) PPML *DUR*	(3) IV – 2SLS Ln(*DUR*)	(4) IV - PPML *DUR*	(5) # of obs
1	Regional Dummies included	0.061 (0.040)	0.080* (0.041)	0.161** (0.076)	0.149** (0.068)	58
2	No China	0.043 (0.033)	0.119 (0.083)	0.175** (0.075)	0.205*** (0.070)	45
3	No India	0.072* (0.037)	0.115* (0.064)	0.195** (0.079)	0.205*** (0.068)	50
4	No Iran	0.082** (0.035)	0.122** (0.060)	0.152*** (0.055)	0.164*** (0.049)	47
5	No Mideast	0.066* (0.035)	0.108* (0.060)	0.167** (0.073)	0.189*** (0.066)	54
6	No Egypt	0.064* (0.035)	0.110* (0.065)	0.169** (0.073)	0.190*** (0.065)	55
7	No SSA	0.074** (0.034)	0.119* (0.063)	0.187** (0.073)	0.201*** (0.064)	57
8	No N. Europe	0.075** (0.034)	0.120* (0.062)	0.199*** (0.074)	0.207*** (0.064)	57
9	No Steppes	0.156*** (0.055)	0.306 (0.233)	0.437*** (0.136)	0.398*** (0.112)	44
10	No SE Asia	0.074** (0.034)	0.119* (0.062)	0.192*** (0.073)	0.204*** (0.064)	58
11	No Mediterranean	0.075** (0.034)	0.076** (0.034)	0.179** (0.072)	0.174*** (0.059)	55
12	Duration >49	0.051* (0.029)	0.103* (0.061)	0.127** (0.051)	0.160*** (0.052)	52
13	Duration >99	0.059** (0.025)	0.099* (0.057)	0.106*** (0.040)	0.132*** (0.042)	36
14	Duration <1000	0.062* (0.032)	0.073** (0.034)	0.163* (0.068)	0.162*** (0.057)	57
15	Begin >600 BCE	0.1078** (0.035)	0.123** (0.059)	0.186*** (0.071)	0.200*** (0.061)	55
16	End <1648 CE	0.065* (0.035)	0.108* (0.062)	0.177** (0.076)	0.196*** (0.069)	55
17	COAST >0	0.496*** (0.157)	0.695*** (0.135)	0.843*** (0.172)	0.719*** (0.144)	48
18	No "water defense" empires	0.078* (0.035)	0.123** (0.062)	0.217*** (0.077)	0.220*** (0.066)	55
	Baseline Results (from [Table 3](#))	0.074** (0.034)	0.119* (0.062)	0.192*** (0.073)	0.204*** (0.064)	58

Standard Errors in Parentheses. *, ** and *** denote significance at the 10%, 5%, and 1% levels. Row 22 removes the following empires that seas provided defensive barriers to a larger extent than for other empires: Almohad and Almoravid.
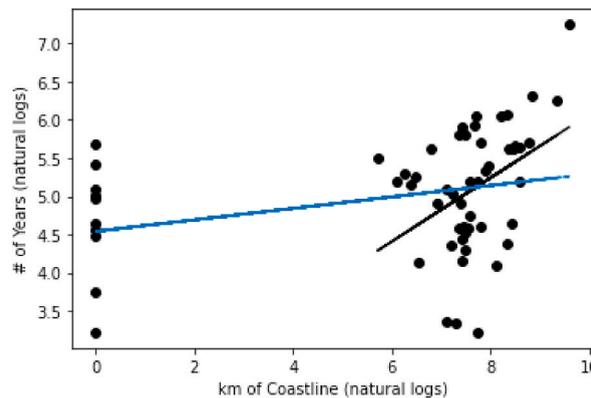

Fig. 2. Regression Lines with and without Landlocked countries.

empires that were territorially large. Despite the smaller threshold, results again remain robust.

5. Integration or defense?

Section [4](#) showed a positive correlation between empire duration and the degree of coastline an empire had relative to its land area when it first became large. The discussion of section [2](#) focused on the benefits of seaways more greatly integrating distinct regions of an empire. However, an alternative explanation is that seas provide strong defenses that protect the empire from invasion. Numerous examples arise. The English Channel has helped to protect the British Isles from invasion for almost a millennium. Many see the Atlantic and Pacific as key in allowing a fledgling U.S. to grow into a world power. Mongol attempts to subjugate Japan and Java ended in disaster, greatly caused by the problems of launching sea-borne invasions.

However, this potential for seas to act as a barrier is less likely to apply in my sample where almost all empires faced overland threats. The Mediterranean did not shield the Roman Empire from barbarian invasions. However, seas could have still served as a partial barrier if troops were less needed along sea coasts and so could be massed at likely invasion routes. On the other hand, the potential for seas to provide a defensive barrier could also be overstated. Seas sometimes facilitated attacks because invaders like the Vikings could more easily travel on water to reach their target. Second, spending resources on a navy allocated resources away from confronting overland challengers. Therefore, it is not clear to what extent the presence of a coast on one side provided a greater potential to deter or defeat overland threats from another direction. A related explanation is that separation by water could have better isolated defeats by providing a 'firewall'. A loss of one province or region need not cascade into a more crushing defeat if territory is

Table 5
500,000 km^2 threshold - Coefficient Estimates for *COAST*.

Row	Dep. Variable	(1) OLS Ln(*DUR*)	(2) PPML *DUR*	(3) IV – 2SLS Ln(*DUR*)	(4) IV - PPML *DUR*	(5) # of obs
1	Regional Dummies included	0.037 (0.034)	0.054* (0.028)	0.127** (0.061)	0.139** (0.056)	69
2	No China	0.017 (0.036)	0.074* (0.036)	0.134*** (0.049)	0.156*** (0.047)	51
3	No India	0.070** (0.035)	0.104** (0.044)	0.159*** (0.054)	0.165*** (0.048)	61
4	No Iran	0.066** (0.030)	0.093** (0.036)	0.124*** (0.040)	0.136*** (0.038)	57
5	No Mideast	0.045 (0.031)	0.080** (0.038)	0.129*** (0.049)	0.144*** (0.045)	65
6	No Egypt	0.046 (0.030)	0.083** (0.038)	0.139*** (0.050)	0.153*** (0.045)	65
7	No SSA	0.052* (0.031)	0.087** (0.037)	0.147*** (0.050)	0.157*** (0.044)	67
8	No N. Europe	0.051* (0.030)	0.087** (0.037)	0.145*** (0.048)	0.155*** (0.043)	68
9	No Steppes	0.090** (0.041)	0.134** (0.052)	0.252** (0.077)	0.233*** (0.065)	55
10	No SE Asia	0.049 (0.030)	0.085** (0.037)	0.142*** (0.048)	0.153*** (0.043)	68
11	No Mediterranean	0.045 (0.030)	0.065** (0.026)	0.139*** (0.048)	0.141*** (0.050)	64
12	Duration >49	0.040* (0.022)	0.079** (0.034)	0.102*** (0.036)	0.128*** (0.036)	61
13	Duration >99	0.059*** (0.019)	0.086** (0.030)	0.097*** (0.027)	0.111*** (0.027)	47
14	Duration <1000	0.045 (0.029)	0.062** (0.025)	0.128*** (0.044)	0.128*** (0.037)	68
15	Begin >600 BCE	0.056* (0.030)	0.094** (0.037)	0.150*** (0.047)	0.155*** (0.040)	64
16	End <1648 CE	0.048 (0.031)	0.082** (0.039)	0.134*** (0.050)	0.149*** (0.046)	66
17	COAST >0	0.091** (0.039)	0.153*** (0.058)	0.265*** (0.081)	0.261*** (0.069)	52
18	No "water defense" empires	0.053* (0.031)	0.090** (0.037)	0.158*** (0.049)	0.166*** (0.043)	66
	Baseline Results	0.052* (0.038)	0.088*** (0.036)	0.146*** (0.047)	0.155*** (0.042)	69

Standard Errors in Parentheses. *, ** and *** denote significance at the 10%, 5%, and 1% levels. Row 22 removes the following empires that seas provided defensive barriers to a larger extent than for other empires: Almohad, Almoravid, Cordoba, Khmer, and the Visigoth Kingdom.

separated by seas. A Byzantine defeat in Italy did not threaten noncontiguous parts of the empire. But again, most of the empires in my sample did not have large noncontiguous components.

Nevertheless, a question remains as to what extent the results from section 4 stem from the ability of seas to foster integration and wealth – key components from Motyl (2001) – versus the potential for seas to provide protective barriers. At least for extreme cases, integration appears the stronger explanation. Three of the four longest lasting empires in the sample were all situated around the Mediterranean: Roman-Byzantine, Fatamid-Mamluk, and Ottoman. See Paine (2013) and Abulafia, 2013 for detailed discussion on how the Mediterranean helped integrate southern Europe, North Africa, and the Middle East. However, all of these empires still faced substantial overland threats. The Mediterranean did not serve as a barrier for Rome or Byzantium to deter invasions from the steppes or from Persia. Although a sea or ocean could have allowed fewer soldiers to be stationed in such areas and so provided some defensive benefits, sizable threats still existed. Moreover, even if an empire faced fewer threats, the potential for internal disintegration remained.

What about the potential of seas separating parts of a empire to serve as a firewall? Very few empires in the sample had large, noncontiguous regions separated by water although exceptions arise such as Rome-Byzantium.[9] Although the Almoravids and the Almohads held territory in North Africa and Iberia, each empire's loss of Iberia preceded its total downfall by only a few years and so did not isolate a major defeat. Moreover, the Strait of Gibraltar is only a few miles in width, providing less benefit as a firewall.

It is also interesting to note that the two longest lasting landlocked empires were the Tibetan empire, located on the defensible Tibetan Plateau, and the Xiongnu Empire which faced little threat from three directions with only China to the south. If proximity to the sea is primarily providing defensive benefits, then the association between seas and duration should be weak since the presence of mountains and deserts would serve similar roles.

To better determine if empires abutting seas were longer-lived because of defensive advantages, row 18 in Tables 4 and 5 remove empires that faced less potential for overland threats (Almoravids, Almohads, Visigothic Kingdom, Cordoba, and Khmer). These empires had extensive coastlines and faced overland threats in limited directions. The latter three were on peninsulas and the first two had the Atlantic Ocean as its main coastline. The coefficients in rows 18 differ little from the baseline case. Admittedly, this examination is informal and indirect. Nevertheless, if defensive advantages were primarily driving results, then these results should weaken when empires potentially receiving the greatest defensive benefits are removed.

6. Conclusion

Strong evidence arises that empires near seas were longer-lived. I interpret the findings to lend more support to integration as the explanation. Nevertheless, even if seas also provided defensive advantages the empirical findings still speak to the importance of geography in influencing historical outcomes. Again, this does not mean that geography's role is definitive. To the extent that geographic characteristics within a region are similar, then geography does not explain why one polity dominates the others.

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[9] I do not consider the possession of minor islands to be substantial enough for this concept of a "firewall" to apply.

Moreover, exceptional individuals such as Alexander the Great or Genghis Khan overcame constraints that bound others. Nevertheless, the extent to which successors could maintain their territories was likely influenced by geography. Both of these land-based empires quickly dissolved upon the conquerors' deaths. Access to the sea appears to provide at least a partial explanation as to why some empires persisted more than others, thereby providing a systemic answer to the question of imperial persistence.

Avenues for future work include finding other proxies for integration that can allow for separate analyses as to what extent they contributed to the survival and durability of history's most important empires.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix. Documentation Regarding Empires

In the below descriptions, dates in **bold** denote the ending dates I use. Beginning dates are provided in Table 1. These do not always correspond to "traditional" dating assignments since what is most relevant for me is the period in which state power is projected. During a decline, for example, my ending date precedes the termination of a dynasty which might hold power but over a small area.

I have listed Chinese empires separately (at the end) because of inherent problems in assigning dynasties to empires. Often, one dynasty replaced another not because they conquered it externally (as with the Yuan Dynasty of the Mongol invasion) but when one elite family replaced the ruling family in something more akin to a palace coup. In these cases, I have combined these dynasties. Such cases are denoted by the full list of dynastic names in the title.

Achaemenid – Persia was conquered by Alexander the Great in **330 BCE**.

Almohad Caliphate –The Almohads lost most of Iberia by **1248** and the rule of the last Almohad in 1269 was consigned mostly to Marrakesh.

Almoravids – They were overthrown by the Almohads in **1147**.

Assyrian (Neo) Empire – The Medes and Babylonians defeated the Assyrians in **608 BCE.**

Avar Khaganate – A defeat by the Byzantines in **626** and then the growing power of the Bulgarians severely weakened them, limiting their territory to Pannonia. They were finally wiped out by Charlemagne in 796.

Bactria – Attacks from Scythians weakened the empire and along with Parthia destroyed it in **125 BCE**.

Carolingian Empire (Frankish) –The Treaty of Verdun in **843** formally split the empire into three realms. These three realms achieved mixed levels of success but were often subdivided themselves among various heirs in subsequent years.

Chagatai Khanate – One of the weakest of the Mongol empires, the Chagatai Khanate was subservient to the Yuan Dynasty until 1260 when it gained autonomy. It achieved its formal independence under Duwa in 1301 but disintegrated following the death of Qazan in **1346**. Although a Chagatai khan sat on the throne, power was decentralized across several rulers. Many of these would be swept aside by Tamerlane in 1370.

Chaldean Empire (Neo-Babylonian Empire) – In **539 BCE**, Babylon was conquered by the Persians.

Cordoba (Caliphate) – After fleeing the Abbasids, Abd-ar-Rahman I became the Emir of Cordoba in 756. He defeated other local rulers and unified much of the surrounding territory. In 929, the empire peaked and Abd-ar-Rahman III took the title caliph. The caliphate persisted until **1031** when it disintegrated into several smaller kingdoms.

Delhi Sultanate (First) – The Mamluk Dynasty formed the initial Delhi Sultanate when it seceded from the Ghurids in 1206. The dynasty was overthrown by the Khilji Dynasty in 1290 which in turn was overthrown by the Tughlaq Dynasty. In **1398**, however, Tughluq power was shattered by Timur (Tamerlane).

Egypt (New Kingdom) – By **1077 BCE**, Egypt had once again fragmented into several parts and lacked central authority.

Egypt (26th Dynasty) –The dynasty lasted until **525 BCE** when Persia conquered Egypt.

Fatamid/Ayyubid/Mamluk – The Fatamid Caliphate was founded in 909 with Ubayd Allah. The Fatamids spread out of Tunisia and conquered Egypt in 969. Fatamid power waned in the 11th century as their hold over western North Africa diminished. Turkic and Crusader armies also pushed the Fatamids out of the Levant. Nevertheless, the Fatamids endured until 1171 when Saladin as vizier overthrew them and founded the Ayyubid dynasty. The Ayyubids quickly expanded out of Egypt. However, they were usurped and pushed out of Egypt by the Mamluks in 1250. The reign of the Mamluks lasted until **1517** when the Ottomans defeated the Mamluks and gained possession of Egypt.

Ghaznavid Dynasty – After a defeat by the Seljuks in 1040 and the sack of their capital in **1151** by the Ghurids, power waned. Much of the Ghaznavid state was then absorbed into the Ghurid Empire in 1175, being finally extinguished in 1186.

Gokturks – In 552 Bumin Kagan defeated the Rouran Khaganate but died soon afterward. Expansion continued under his son Muqon. Despite the secession of the western part of the Khaganate, rule in the East continued until the Gokturks were defeated by a Tang Army in **630**.

Golden Horde – An offshoot of the Mongolian Empire, the Golden Horde advanced westwards under Batu in 1235 before

withdrawing due to the death of the Great Khan. It formerly broke off from the Mongol Empire in 1310. The Golden Horde remained a strong power until it was defeated by Timur in 1396. The Khanate of Kazan broke off in **1438** followed by several other Khanates. The last of the Golden Horde was defeated by the Crimean Khanate in 1502.

Gupta Empire – The Guptas became leaders of Magadha in the early 4th century. Chandragupta I ascended the throne in 320 and expanded his territory along the Ganges River. His successor, Samudragupta, continued this expansion until 380, reaching the Indus River as well as following the eastern coastline into the Deccan. Their golden age persisted until 470 when invasions from the Hephthalites (or White Huns) weakened the empire. By **500**, much of Northwest India had been overrun. The Guptas maintained a rump state until 550 but their power had clearly waned.

Gurjara-Pratihara – Although the empire quickly expanded under Bhoja, upon the death of Bhoja's son in **910** the empire soon fragmented and was defeated by external powers.

Harsha – Harsha became leader of a growing but small north Indian kingdom in 606. He expanded his territory throughout northern India though he was checked by the Chalukyas in the south. His territory peaked in 625. Upon his death in **647**, his empire quickly broke apart.

Hunnic Empire – The Huns were a loose federation of tribes until Oktar unified them in 420. Upon his death in 434, control passed to his nephews, one of whom, Attila, later gained sole control. Upon his death in 453, the empire broke apart, completely dissolving in **469**.

Ilkhanate – Founded by Hulagu Khan (a grandson of Genghis Khan) in 1256, the khanate was nominally subservient to the Great Khan of the Yuan dynasty but was largely independent. The khanate dissolved in **1335** with the death of Abu Said.

Kara Khitan Khanate (Western Liao) – They were destroyed by Genghis Khan in **1218**.

Khazar Khanate –The Khazars remained a powerful state in the Eurasian steppe until defeated by the Rus in **969**.

Khmer Empire – The Khmer Empire peaked in 1290. By **1350**, however, the Ayutthaya Thais became a rival state. They not only encroached on Khmer territory but sacked the capital twice. Although the Khmer Empire lingered until 1431, the last decades saw further declines.

Khwarezmid Empire – Originally a principality in of the Seljuks in Central Asia, Khwarezm seceded in 1156. Khwarezm fought recurrent wars with the Kara Kitans with mixed success. The empire was destroyed by Genghis Khan in **1220**.

Kiev Rus – Kievan power grew after 882 when Prince Oleg unified various Slavic peoples and established his capital at Kiev. Another round of territorial expansion occurred in the last decades of the 10th century, peaking in 1000. However, internal strife led to internal fragmentation so that central authority had greatly weakened in **1132** following the death of Mstislav the Great, the last leader to lead a unified state. The Mongols destroyed Kiev in 1240.

Kushan Empire – After the death of Vasudeva in **230**, the empire disintegrated and succumbed to attacks from the Sassanid and Gupta empires. Although the Kushan Kingdom existed until late in the 4th century, it was a shell of itself.

Liao (Khitan) – The Empire persisted until it was conquered by the invading Jinn (Jurchens) in **1125**.

Mali Empire – The Mali Empire was founded by Sundiata Keita in 1235 when his tribe defeated the Sosso Kingdom of Kaniaga. It reached its height in 1380. However, raids by the Tuareg's and then the encroaching Songhay Empire had greatly weakened Mali by **1545**. Although Mali survived for another century it was no longer noted for its wealth or power.

Median Empire –The Median Empire was usurped by the Persians in **550 BCE.**

Mongol/Yuan – When Kublai Khan died in 1294, the Mongol Empire split into four separate empires, the Yuan being one of them. In **1368**, the Yuan dynasty was overthrown by the Ming dynasty.

Mughal Empire – The dates spanning the Mughal Empire are often ascribed to be 1526–1857. In 1526, the Mughals drove the last of the Delhi Sultanates out of Delhi. But the Mughals were then quickly driven out of Delhi by the Sher Shah Sur from Afghanistan. The Mughals returned to power in 1556 and this time their reign was long lasting, quickly expanding across India. The rise of the Marathas, however, pushed back Mughal authority and the Marathas sacked Delhi in **1737**. With the British also making inroads into India, de factor Mughal authority was limited to Delhi. In 1857, the British deposed the Mughals for their support of the Great Rebellion.

Maurya/Sunga Empires – Mauryan power waned after Ashoka the Great's death in 232 BCE. The last Mauryan king was killed by the commander of his guard, Pusyamitra Sunga, in 185 BCE who founded the Sunga dynasty. Although not as expansive as the Mauryan Empire, the Sunga Empire remained a force in northeastern India until it disintegrated after **141 BCE** although a small section survived until 73 BCE**.**

Ottoman Empire – Ottoman rule endured until **1922** when the empire fragmented.

Parthian Empire – The Parthian Empire lasted until **224** when it fell to the Sassanids.

Ptolemaic Kingdom – Founded in 305 BCE when Ptolemy, Governor of Egypt, broke off from the Macedonian Empire, it survived until **30 BCE** when it became a Roman province.

Roman Republic-Empire-Byzantines – I set the end of the empire in **1204** when crusaders sacked Constantinople and formed the Latin Empire. Despite regaining Constantinople in 1261, the empire was a shell of itself. Its territory was limited to the surrounding area and was killed off by the Ottomans in 1453.

Rouran Khaganate – A confederation of steppe tribes unified under Yujiulu Shelun in **402**, the Rouran controlled part of the Silk Road. They were ultimately defeated by an alliance of Gokturks, Wei, and Qi forces in **552**.

Saffarids – Defeat to the Samanids in 901 relegated them to a minor power.

Samanids – Founded by Saman Khuda in 819, early rule was limited to Khorasan and Transoxiana as Abbasid governors. However, they were effectively independent by 875. Their power grew in 893 under Ismail I as he expanded his territory and defeated the Saffarids in 901. Their territory peaked in 928. Samanid power declined in the second half of the tenth century and in **999** was defeated by the Ghaznavids and the Karakhanids.

Sassanid Persia – Sassanid power peaked in 615 with the capture of Egypt. However, the Byzantines recaptured some of the lost territory and the empire did not survive the Muslim expansion in **651**.

Seleucid Empire – One of the four breakaway regions from the Macedonian Empire, Seleucus established control over his territory in Mesopotamia in 312 BCE. Seleucus began expanding his territory in 320 BCE toward both India and Syria. The empire faced several crises in the middle of the 3rd century BCE but was revived under Antiochus the Great. However, Roman power checked Seleucid expansion. In **129 BCE**, the Seleucids were soundly defeated by the Parthians and civil war tore the empire apart. Their domain was restricted to Syria. In 63 BCE, Rome wiped away the Seleucids and made Syria into a province.

Seljuks – Internal dissension weakened the empire after the death of Malik Shah I in 1092 and the Seljuks were defeated by the Karakitans in **1141**. The empire quickly then fragmented into several parts.

Songhai Empire – Internal struggles weakened the empire and it was then destroyed by Moroccan forces in **1591,** most decisively at the Battle of Tondibi.

Tibetan Empire –The Empire lasted until **842** when internal power struggles caused its disintegration. Although nominally still in existence until the 1240's with the invasion of the Mongols, central authority was lacking.

Timurid Empire – Founded in 1370 when Timur (Tamerlane) became leader of the Ulus Chagatay, the empire quickly expanded by conquest and reached its apex around 1405. Iran was lost to the Safavids in 1501 and the important cities of Herat and Samarkand fell in 1505 and **1507**, respectively. Little territory remained when the empire was finished off in 1526.

Umayyad/Abbasid – The Abbasids displaced Umayyads as Caliphate but both ruled the same Muslim world. Over time, Abbasid controlled territory shrank. The traditional date of the ending of the Abbasid Caliphate is 1258 when Baghdad was sacked by the Mongols. Nevertheless, the Caliph held little power after Al-Qahir was forced to abdicate in **934**.

Uyghurs – The rise of the Uyghurs occurred in 744 under Qutlugh bilge köl when the Uyghurs revolted from the Gokturks. The Uyghurs soon gained power of the other rebellious tribes and expanded until they were defeated by the Kyrgyz in **840**.

Visigothic Kingdom – A defeat by the Franks in 507 drove them out of Gaul but they retained their land south of the Pyrenees until the Moors conquered them in **711**.

Western Turks – A leadership crisis emerged among the Gokturks following the death of Taspar Kagan in 584. A leader named Tardu emerged in the West and broke away from the "eastern" Gokturks. Power waned for the Western Turks as further secessions occurred until they were defeated by a Tang army in **657**.

Xiongnu Empire – The Xiongnu were united in **209 BCE** by Modu Chanyu and quickly conquered its neighbors. In 55 BCE, succession crises led to the fragmentation of the Empire into two halves. The Western Xiongnu were destroyed in 36 BCE. The Eastern Xiongnu further fragmented into North and South blocs in **48** with the South soon becoming dependent upon the Han. The northern Xiongnu were conquered by the Xianbei in 85.

China.

Western Zhou – The Zhou dynasty begin in 1046 BCE when King Wu of Zhou overthrew the Shang dynasty.[10] The empire fell in **771 BCE** when a rival aided by outside forces killed King You. The Zhous migrated east to form the Eastern Zhou dynasty but their power remained nominal as local rulers held real power.

Chu – Originally a tributary state of the Western Zhou dynasty, Chu defeated Zhou in 957 BCE. It then grew in power throughout the "Spring and Autumn" period after the downfall of the Zhou in 770 BCE. Chu fortunes waxed and waned but it remained one of the two most powerful states within China until defeats by the Qin in **223 BCE** severely weakened it.

Qin Dynasty – The traditional beginning of the Qin Dynasty is 221 BCE with the reign of Shi Huangdi. However, Qin became a powerful state within China in 316 BCE when it defeated Shu. Despite some subsequent defeats, it re-emerged as an expansionist power when it inflicted a severe defeat upon Chu in 277 BCE. Expansion continued and Shi Huangdi conquered China by his death in 210. The dynasty then disintegrated and fell in **206 BCE**.

Han Dynasty – In **220**, the empire fragmented into the Three Kingdoms of Wei, Shu, and Wu.

Wei/Jin/Eastern Jin/Liu Song/Southern Qi/Liang/Chen Dynasties – The Kingdom of Wei, located in northeastern China, arose out of the fragmentation of the Han Dynasty in **220** and was first led by Cao Pi. Power of the Cao clan weakened and the Sima family became the de facto power behind the throne. In 265, Sima Yan forced Cao Huan to abdicate and Sima Yan proclaimed the Jin Dynasty. The Jin Dynasty was able to briefly re-unify China but for only ten years from 280 to 290 as internal struggles weakened it. Uprisings and power grabs forced the Simas to flee south in 316 where they established the Eastern Jin Dynasty and continued to rule the southern half of China. The Eastern Jin lasted until 420 when palace usurpations became frequent leading to the Liu Song (420–479), the Southern Qi (479–520), Liang (520–557), and Chen (557–589) dynasties. The Chen dynasty was conquered by the Sui dynasty in **589**.

Shu Dynasty – One of the Three Kingdoms arising out of the Han Dynasty, the Shu Dynasty was founded by Liu Bei in 221. It lasted four decades when it fell to the Wei Dynasty in **263**.

Wu (Eastern Wu) Dynasty – The Wu Dynasty was another of the Three Kingdoms that arose from the fall of the Han Empire in 220. It was conquered by the Jin Dynasty in **280**.

Earlier Zhao – One of the Sixteen Kingdoms, it rose in 304 when it seceded from the Jin Dynasty. It was defeated in **329** by the Later Zhao dynasty.

Later Zhao/Former Qin – One of the Sixteen Kingdoms arising from the fall of Jin Dynasty, the Later Zhao rose in 319 when it

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[10] The Shang Dynasty is not included in this list for two reasons. Their origins are murky, making the establishment of a beginning date more problematic than for other cases. Second, to what extent their territory was contiguous is also unclear.

seceded from the Earlier Zhao. In 351, a rebellion by one of its officers usurped the dynasty and established the Former Qin dynasty. It briefly unified northern China but was brought down through internal disintegration and a defeat by the Eastern Jin in **383**. Although it survived another 11 years, its power was greatly reduced.

Northern Wei/Western Wei/Northern Zhou/Sui – Northern Wei broke free of the Later Yan in 398 during the period of the Sixteen Kingdoms. By 439, it had unified northern China. However, internal dissent caused its split and the loss of Eastern Wei in 534 and so the surviving state was called the Western Wei. Palace coups first saw the rise of the Northern Zhou in 557 and then the Sui in 581. However, the unification of China proceeded during these dynasties and culminated in 589. Wars and infrastructure projects bankrupted the dynasty, provoking large scale rebellions throughout China and precipitating the fall of the Sui in **618** by the Tang.

Eastern Wei/Northern Qi – In 534, the Northern Wei Dynasty split into Eastern and Western parts. The de facto ruler of Eastern Wei was Gao Huan. In 552, his son, Gao Yang deposed the nominal emperor and started his own dynasty, the Northern Qi. In **577**, Northern Qi was conquered by the Northern Zhou dynasty.

Tang Dynasty – The dynasty gained power in 618 with the defeat of the Sui. In 763 the An Lushan rebellion severely weakened the empire. Only with outside help were the Tangs able to put it down. Regional governors gained autonomy, including making their positions hereditary. A period of recovery began in the early 9th century but a second major rebellion in **875** rocked the empire and quickly led to fragmentation although the traditional fall of the Tang dynasty is 907.

Jin/Later Tang/Later Jin – The state of Jin was one of the kingdoms arising from the fall of the Tang in 907. Li Cunxu overthrew the Jin dynasty in 923 and proclaimed the Later Tang Dynasty. The Later Tang was overthrown by a coup in 936 which saw the ascendance of the Later Jin in 936. The Later Jin was then conquered by the Khitan Liao in **947**.

Later Han/Later Zhou/Song – The Later Han was founded by Liu Zhiyuan in 947. A succession crisis among the Khitan created a power vacuum and enabled Liu to declare his own state and dynasty. Liu soon died and power was then usurped by Guo Hei who declared the start of the Later Zhou Dynasty in 951. The Later Zhou was then overthrown by Zhao Kuangyin in 960 who proclaimed the Song dynasty. The Song dynasty unified China. But in 1126, Jurchen invaders pushed the Song out of northern China and established the Jinn dynasty. The Song dynasty was then limited to southern China until **1279** when it was destroyed by the Mongols.

Jinn Dynasty – The Jinn Dynasty arose from the Jurchens who unified under Wanyan Aguda in 1115. They defeated the Liao Khitans and by 1127 had pushed the Song Dynasty into southern China. The Jinns controlled northern China until the Mongols conquered them in **1234**.

Ming Dynasty – One of these rebel groups revolting against the Yuan was led by Zhu Yuanzhang who amassed considerable territory by 1361. After defeating the other factions, he captured Dadu (Beijing) in 1368 and established the Ming Dynasty. The Mings ruled China until **1644**. After several revolts had weakened the empire, the Manchus invaded, pushing the Mings to southern China. Although some Mings held out until 1662, their power was limited.

Qing Dynasty – In 1644, Manchu invaders deposed the Mings and established the Qing dynasty. Their conquest of China was complete by 1683. Although the last Qing emperor did not abdicate until 1912, Chinese power had severely waned due to the Opium War and Taiping Rebellion which foreign troops eventually helped to quell. The Qing Dynasty fell in **1912** and China became fragmented again.

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