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Power and Size:Urbanization and Empire Formation in World-Systems

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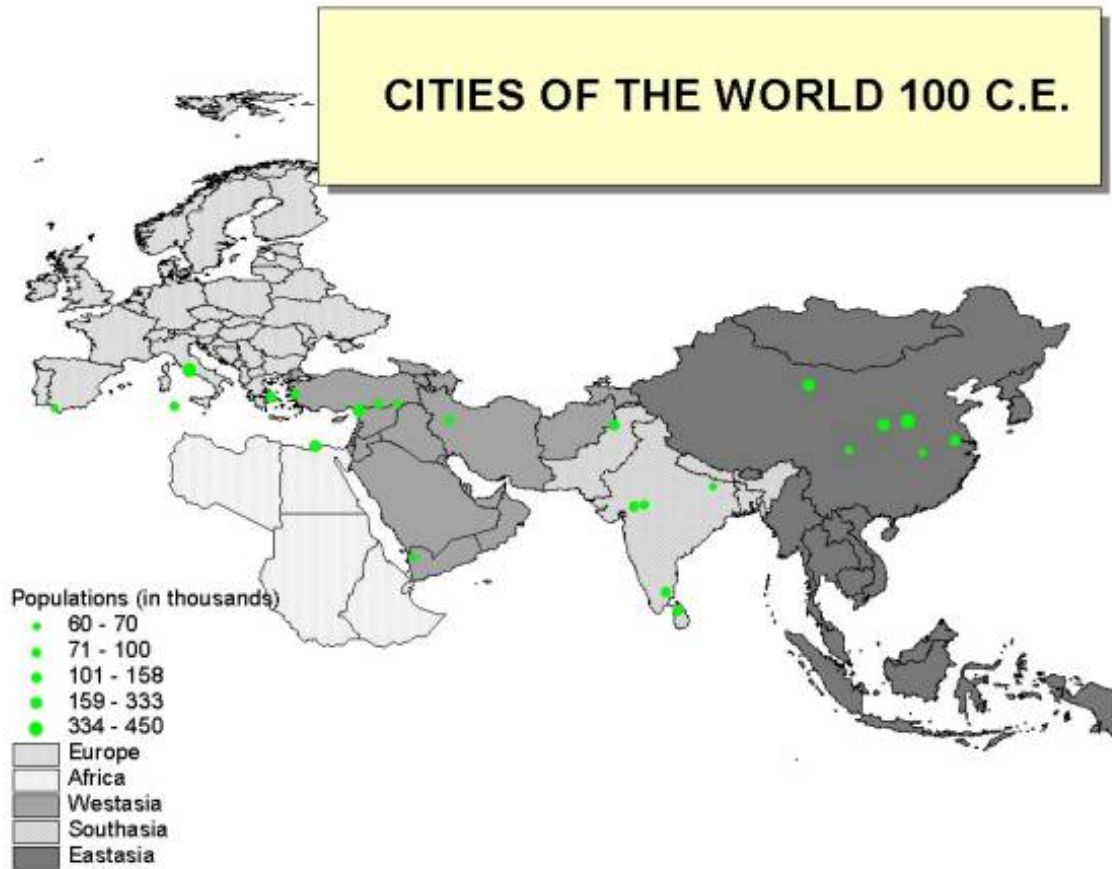
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CITIES OF THE WORLD 100 C.E.

Populations (in thousands)
- 60 - 70
- 71 - 100
- 101 - 158
- 159 - 333
- 334 - 450

Europe
Africa
Westasia
Southasia
Eastasia

Abstract: This paper contains an overview of earlier research on city and empire growth/decline phases and new evidence on the relationship between urban growth and the rise and fall of empires in six world regions. We find that empires and cities grow and decline together in some regions but not others. We also examine the temporal correlations between growth/decline phases of largest and second largest cities and empires within regions. Do large empires grow at the expense of other large states within a region or are there periods of regional growth in which states (and cities) are growing together?

Earlier research has demonstrated the utility of studying settlement systems and networks of interacting polities as windows on the historical development of social complexity and hierarchy. By knowing the population sizes of settlements and the approximate territorial sizes of states and empires we can compare rather different time periods and regions in order to discover both regularities and uniquenesses. This paper briefly summarizes the results of earlier studies using city and empire sizes and presents new results on the relationships between changes in urban populations, city-size distributions and the territorial sizes of states and empires. Archaeologists often assume that the concentration of political power can be inferred from the rise of a size hierarchy of settlements – increases in the steepness of the settlement size distribution (e.g. Kowalewski 1982). This hypothesis can be tested by using existing data, though more certain results await the improvement and greater temporal resolution of data on city and empire sizes.[1] Chase-Dunn and Willard (1993) examined urban growth and city-size distributions in nine different regional political/military networks (PMNs)[2] using data on city sizes from Tertius Chandler's (1987) compendium. Political/military networks (PMNs) are interstate systems – systems of adjacent conflicting and allying states. David Wilkinson (1987) bounds these expanding and contracting systems of states as they merge or become incorporated into what Wilkinson calls the "Central System." Chase-Dunn and Willard (1993) plotted changes in the Standardized Primacy Indices (a measure of the steepness of the city-size distribution) over time, and read descriptions of what was happening in the different systems to examine the hypothesis that changes in the city-size distribution was related to changes in the degree of political integration and the centralization of state power in nine different PMNs. They also accidentally discovered a synchronicity of changes in city size distributions and phases of urban growth/decline in the East Asian and the West Asian-Mediterranean PMNs over a long period from about 650 BCE to about 1500 CE.[3]

This latter discovery led to further research using data on the territorial sizes of empires gathered by Rein Taagepera (1978a, 1978b, 1979,1997). That analysis ([Chase-Dunn, Manning and Hall 2000)](#) found additional evidence for synchronicity between the East Asian and the West Asian-Mediterranean PMNs over this same 2150 year period, and confirmed what had also been indicated by scant city size data from India, that the Indic PMN was marching to a different drummer.

These synchronicity results were further confirmed by additional analysis of the city data by Chase-Dunn and Manning (1998). That study examined synchronicities by comparing constant regions rather than PMNs. PMN boundaries change over time because of the expansion of the Central System, whereas specified regions that are held constant over time can constitute a different, but related, unit of analysis. Chase-Dunn and Manning found support for the synchronicity phenomenon using constant regions, and so this phenomenon is not likely to be an artifact of the way in which units of analysis have been constructed.

Power, Urban Growth and Urban Size Hierarchies

This paper returns to the question asked in the Chase-Dunn and Willard (1993) study about the relationship between urban growth, city-size distributions and the rise and fall of empires. What is the relationship between the size of settlements and power in intergroup relations? Under what circumstances does a society with greater population density have power over adjacent societies with lower population density, and when might this relationship not hold?Population density is often assumed to be a sensible proxy for relative societal power. Indeed, Chase-Dunn and Hall employ high relative population density as a major indicator of core status within a world-system (Chase-Dunn and Hall 1997). But Chase-Dunn and Hall are careful to distinguish between "core/periphery differentiation" and "core/periphery hierarchy." Only the latter constitutes actively employed intersocietal domination or exploitation, and Chase-Dunn

and Hall warn against inferring power directly from differences in population density.

In many world-systems military superiority is the key dimension of intersocietal relations. Military superiority is generally a function of population density and the proximity of a large and coordinated group of warriors to contested regions. The winner of a confrontation is that group that can bring the larger number of warriors together quickly.This general demographic basis of military power is modified to some extent by military technology, including transportation technologies. Factors such as better weapons, better training in the arts of war, faster horses, better boats, greater solidarity among soldiers and their leaders, as well as advantageous terrain, can alter the simple correlation between size and power.

The most important general exception (in comparative evolutionary perspective) to the size/power relationship is the phenomenon of semiperipheral development (Chase-Dunn and Hall 1997:Chapter 4). The pattern of uneven development by which formerly more complex societies lose their place to "less developed" societies takes several forms depending on the institutional terrain on which intersocietal competition is occurring.Less relatively dense semiperipheral marcher chiefdoms conquer older core chiefdoms to create larger chiefly polities. Likewise, semiperipheral marcher states, usually recently settled peripheral peoples on the edge of an old region of core states, frequently are the agents of a new core-wide empire based on conquest. Less dense semiperipheral Europe was the locus of a virile form of capitalism that condensed in a region that was home to a large number of unusually proximate semiperipheral capitalist city-states. This development, and the military technology that emerged in the competitive and capitalist European interstate system, made it possible for less dense Europe to erect a global hegemony over the more densely populated older core regions of Eurasia. The more recent hegemonic ascent of formerly semiperipheral national states such as England and the United States are further examples of the phenomenon of semiperipheral development.

The phenomenon of semiperipheral development does not totally cut away the general observation of a correlation between power and size. What it shows is that this correlation can be overcome by other factors, and that these processes are not entirely random. Denser core societies are regularly overcome or out-competed by less dense semiperipheral societies, but it does not follow that all semiperipheral or peripheral regions have such an advantage. On the contrary, the majority of low-density societies are subjected to the power of more dense societies.Semiperipheral development is a rather important exception to this general rule.

Why should a city system have a steeper city size distribution when there is a greater concentration of power? The simple answer is that large settlements, and especially large cities, require greater concentrations of resources to support their large populations. This is why population size has itself been suggested as an indicator of power (Taagepera, 1978a: 111). But these resources may be obtainable locally and the settlement size hierarchy may simply correspond to the distribution of ecologically determined resources. People cluster near oases in a desert environment. In such a case it is not the political or economic power of the central settlement over surrounding areas that produces a centralized settlement system, but rather the geographical distribution of necessary or desirable resources. In many systems, however, we have reason to believe that relations of power, domination and exploitation do affect the distribution of human populations in space. Many large cities are as large as they are because they are able to draw upon far-flung regions for food and raw materials. If a city is able to use political/military power or economic power to acquire resources from surrounding cities it will be able to support a larger population than the dominated cities can, and this will produce a hierarchical city size distribution.

Of course the effect can also go the other way. Some cities can dominate others because they have larger populations, as discussed above. Great population size makes possible the assembly of large armies or navies, and this may be an important factor creating or reinforcing steep city size distributions.

The relationship between power and settlement systems is contingent on technology as well as political and economic institutions. Thus we expect to find that the relationship between urban growth and decline

sequences and the growth decline sequences of empires varies across different systems or in the same regional system over time as new institutional developments emerge. We know that the development of new techniques of power, as well the integration of larger and larger regions into systems of interacting production and trade, facilitates the emergence of larger and larger polities as well as larger and larger cities. Thus there is a secular trend at the global level and within regions between city sizes and polity sizes over the past six millennia. But the question we are asking here is about finer temporal and spatial relationships. Do cities and empires rise and fall together? Are there important exceptions to this pattern? What are the causalities involved?

We may also ask whether or not the causal relations are stable over time within regions? We expect that there may be periodic changes in the relationship between power and size as new institutions develop. The rise of capitalism as an alternative source of power to military might and changes in the relationship between military power and demographic factors most likely change the nature of the connections between size and power. We know that empires ceased to increase in territorial size with the demise of the modern colonial empires. And the contemporary world city system may be unique in the extent to which some of the largest cities are located in the semiperiphery rather than in the core. These observations suggest that we should try to overcome the difficulties encountered in studying the last two centuries in order to shed more light on the power-size relationship.[4]

We will further examine the relationship between power, urban growth and settlement size hierarchies by comparing trends in the growth/decline sequences of city populations and the territorial sizes of empires. Our units of analysis will be:

> 1.Political/Military Networks (PMNs), otherwise called interstate systems;
>
> 2.Constant Regions[5], in order to see how spatial boundaries might be related to patterns in the city-empire relationship; and
>
> 3.Polities (states and empires), because the simplest form of the hypothesis of a causal relationship between power and urbanization is that larger states can afford to create larger cities.

And we will examine the temporal relations between the simple sizes of cities and empires, as well as size distributions of cities and the size of empires when data are available.

 Measurement of the population sizes of cities and the territorial sizes of empires is not without difficulties, especially for early periods. How can we know the number of people who reside in Los Angeles today? We use the most recent census, a survey of "residents" conducted by the U.S. federal government. What are the spatial boundaries of "Los Angeles"? Do we mean the city of Los Angeles, Los Angeles County, the contiguous built-up area that constitutes "greater Los Angeles," or a definition based on the proportion of the local population that is employed in "Los Angeles"? Does "Los Angeles" include San Diego? Nighttime satellite photos of city lights reveal a single unbroken gigalopolis from Santa Barbara to Tijuana:

So where is Los Angeles? We want to use the contiguous built-up area as our main way of spatially defining cities. For early cities we do not have official, and ostensibly complete, census figures. Thus we rely on methods that archaeologists and students of early urbanization have developed to estimate the population sizes of cities.

These involve, for example, determining the spatial size of the city and then estimating the population density per unit of area and so estimating the total population. Population density varies depending upon the size of families, the nature of dwellings, the amount of non-residential area within settlements, and cultural differences. Anthropologists and archaeologists have made an important effort to produce reliable methods for estimating population sizes from residential areas (e.g.Brown 1987), and the famous historical demographer Paul Bairoch (1988: 21-4) has examined the problem of urban population densities in

comparative perspective.

Tertius Chandler (1987) used reports about the number of soldiers to estimate city sizes, assuming that an army of men represents, on the average, about ten percent of the population of the city in which the army resides. Such estimates are obviously error-prone. Another problem with existing data on both city and empire sizes is that they were produced from surveys of both secondary and primary sources that are now, in many cases, obsolete because more recent and better research has been published by archaeologists, epigraphers and historians. Chandler's compendium was mainly based on his thorough survey of the contents of the main library at the University of California, Berkeley over the four decades prior to its publication in 1987. A new project to improve upon Chandler's compendium of city sizes is under way at the Institute for Research on World-Systems at the University of California, Riverside.

Estimating the territorial sizes of empires is also problematic. Taagepera used atlases and maps to produce his estimates of the spatial sizes of empires from 3000 BCE to the present. But the boundaries of empires are not usually formally specified, but are rather a matter of degrees of control that fall off with distance from the central region. Archaeological evidence of the presence of a core culture in a peripheral region does not prove the existence of control, because many core polities have established colonial enclaves in distant peripheries to facilitate trade (e.g. Stein 1999). So the estimation of empire sizes is also fraught with difficulties. But, as with city sizes, a significant improvement of accuracy, temporal resolution and coverage would result from a renewed effort to code empire sizes using recently published materials. This is another [6] task that the IROWS City-Empire Research Working Group will undertake.

Dating is also a major problem in studying temporal relationships in the ancient world-systems. In this paper we utilize the years originally supplied by Taagepera and Chandler. But the dating of events and city size estimations for the millennia BCE is a matter of continuing dispute among scholars of ancient history. For ancient Western Asia the Egyptian dynastic dates are used, but these have been repeatedly revised with an error margin of around 25 years. This is a threat to any study of temporal correlations.

Mesopotamia

The first PMN we shall examine is that of Mesopotamia from 2800 to 550 BCE. It is mistaken to speak of a single West Asian/North African world-system for this whole period. Rather two core areas – Egypt and Mesopotamia – were undergoing developmental processes that were only weakly linked, especially at first. As both of these systems expanded their trade networks and political/military interaction networks they came into contact with one another. The prestige goods nets (PGNs) became linked as early as 3000 BCE (Marfoe 1987) or as late as 2250 BCE (Wilkinson 1992), while the Mesopotamian and Egyptian

Map of Ur.
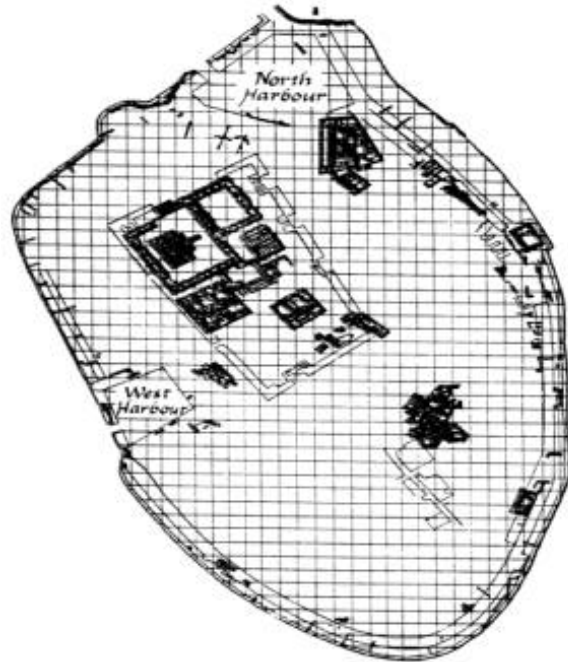
political/military networks became linked by the Egyptian expedition to Syria (about 1520 BCE). We examine the relationship between the population size of the largest city and the territorial size of the largest state or empire in a region as these change over time. The hypothesis of a correspondence between urbanization and the size of polities should reveal a positive correlation in these two measures over time. The data on city population sizes are especially sparse for early millennia and the time points of estimates are widely spaced, making temporal correlation risky. For Mesopotamia our data set is thus:

Year (BCE)	Empire Size (square megameters x10)	Empire Name	City Size (thousands)	City Name
-2800	1	Kish	80	Uruk*
-2500	3	Kish	50	Uruk*
-2400	5	Lagash		
-2300	65	Akkadian	36	Agade*#
-2200	25	Akkadian		
-2100	3	Ur		
-2000	10	Sumer	65	Ur
-1900	0			
-1800	10	Old Assyria	29	Mari
-1700	25	Babylon		
-1600	16.6	Babylon	60	Babylon
-1500	10	Kassite		
-1450	10	Kassite		
-1400	10	Kassite		
-1360	21.7	Hittites	45	Khattushash (Hattusa)

-1350	5	Assyria	45	Khattushash (Hattusa)
-1300	10	Assyria		
-1250	15	Assyria		
-1200	25	Hittites	48	Khattushash (Hattusa)
-1150	5	Assyria		
-1100	40	Assyria		
-1050	15	Babylon		
-1000	15	Babylon	51	Babylon
-950	15	Babylon		
-900	15	Babylon		
-850	40	Assyria		
-800	57.9	Assyria	50	Calah
-750	40	Assyria		
-700	90	Assyria		
-650	93.3	Assyria	120	Nineveh
-600	25	Babylon		
-550	50	Babylon		

Table 1:Mesopotamian Largest Empires and Cities

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*These estimates are from Modelski (1997). All other estimates are based on Chandler and Taagepera.
#Archaeologists have not yet decided which of the thousands of tells in Iraq is Agade, the capital of
Sargon's Akkadian empire.
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Table 1 immediately demonstrates problems of missing data, especially for the third millennium. The time points for city sizes are far apart, and there are obviously missing cases. We have Modelski's (1997) best estimate of the population size of Uruk in 2800 and 2500 BCE, but the largest empire shown in Taagepera's data is that of Kish, a city-state that was independent of the much larger empire of Uruk in this period. This obvious error strongly demonstrates the need for upgrading the data sets we are using. In the data presented in Table 1 and in the figures and tables below we have interpolated Taagepera's dates of changes in the sizes of empires to regular time intervals (every 50 years in Table 1 and Figures 1 and 2; every 10 years for the other regions in Table 2 and the figures in Appendix A).

Another complication revealed in Table 1 is as follows: in 1350 and 1200 BCE the largest city is Khattushash (Hattusa), the capital of the Hittite empire, but the largest empire in the Mesopotamian region is the Neo-Assyrian Empire. This raises the issue of the proper unit of analysis – regions or polities – but it also raises a theoretical issue. The simplest version of the size-power hypothesis is that larger empires can afford larger cities, and to test this hypothesis we would need temporally fine-grained data on the size of the largest city within each empire. For this purpose the unit of analysis should be the polity (states and empires). But it may also be the case that regions or PMNs experience cyclical periods of growth and decline in which all the states and cities are growing, or alternatively that state and city growth is a zero-sum game in which growth in some results or is related to decline in others. By using and comparing different spatial units of analysis we can examine these competing hypotheses.
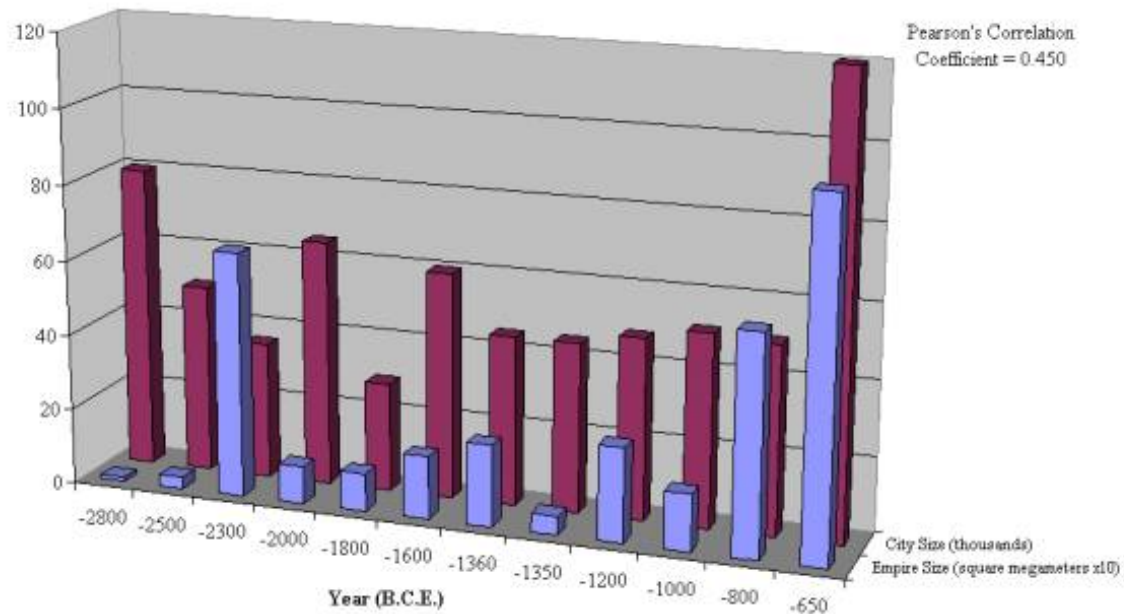
Mesopotamia

Figure 1: Largest Mesopotamian Cities and Empires

The temporal relationship between the size of the largest city and the size of the largest empire is positive for the Mesopotamian case with a positive Pearson's r correlation coefficient of .59 based on ten time points for which we have data for both variables. This supports the hypothesis of a causal relationship between these features of the social landscape, but the positive association could also be due to other factors or to the secular trending of these characteristics. We will return to these issues when we have more and better data in the cases to be discussed below.

Egypt

As with Mesopotamia the data for Egypt are few and problematic. But using what we have produces the results displayed in Figure 2.
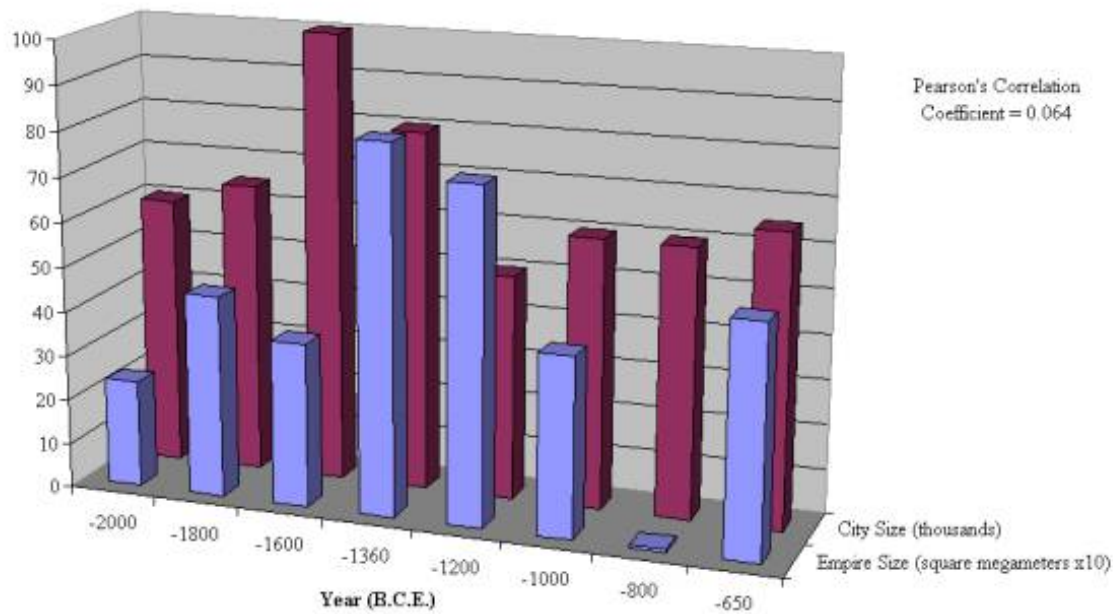
Figure 2: Largest Egyptian Cities and Empires

The temporal relationship between city and empire sizes in Egypt is also positive, producing a Pearson's r correlation coefficient of .52 based on seven time points on which we have data for both variables. Though there is a secular upward trend, both city and empire sizes also reveal decline phases and these are roughly synchronous with one another, though the few estimates of city sizes makes a firm conclusion risky.

Heliopolis 26

Memphis 28

Thebes 65

Population (in thousands)
- 20
- 21 - 25
- 26 - 30
- 31 - 40
- 41 - 65

CITIES IN EGYPT 1800 B.C.E

Size and Power in Regions

Table 2 (below) presents the bivariate Pearson's r correlation coefficients between empire and city sizes for all of the regions for which we have sufficient data to study in this way. It also presents the partial correlations controlling for year to remove the long-term upward trend between city and empire sizes. The Americas and Africa do not have enough city size data, though this deficiency could and should be remedied by a new coding project.

Table 2 shows that four of the six regions have statistically significant positive bivariate correlations between city and empire sizes (Column 2). This lends support to the contentions discussed above of a causal interaction between power and size, but these correlations do not shed light on the question of the direction of the causal effects. Once we have improved data we plan to employ the test of antecedence to shed light on this. We should also note the two of our regional "cases" overlap with one another, Mesopotamia and West Asia.

Regional correlations between city and empire sizes

Region	Pearson's r	Partial Pearson's r	# of time points	Years
Egypt	0.064	0.062	8	2300 B.C.E. - 550 B.C.E.
Mesopotamia	0.380*	0.299	13	2800 B.C.E. - 550 B.C.E.
East Asia	0.473**	0.122	30	1360 B.C.E. - 1800 C.E.
Europe	0.817**	0.744**	32	430 B.C.E. - 1800 C.E.
South Asia	0.286	0.126	15	600 C.E. - 1800 C.E.
West Asia	0.636**	0.562**	27	2000 B.C.E. - 1500 C.E.

* Pearson's r significant at the 0.05 level.
** Pearson's r significant at the 0.01 level.

Table 2: Regional correlations between city and empire sizes

One problem with thebivariate results in Column Two of Table 2 is that the positive correlations may be due to the secular trends rather than to medium-term oscillations. Both city and empire sizes increase over the long run.[7]

There are two ways to remove the effects of the secular upward trend. The first is to compute partial correlations controlling for time. These results are presented in Column 3 of Table 2. The other method of

detrending would compute first differences -- the change scores from one period to the next. The irregular (and infrequent) time points of the early city size data make change score detrending messy, so this should only be done after more regular intervals of measurement have been established.

The detrended partial correlations in Column Three of Table 2 show that there are important differences among regions with respect to the relationship between city and empire sizes. The main difference between the bivariate and detrended partial correlations is in the East Asian region. The rather substantial and statistically significant East Asian bivariate correlation of .47 drops to .12 when the long-term trend is taken out. Another difference is that the relationship in Mesopotamia is reduced from .38 to .30. The South Asian correlation also decreased, but it was already low and insignificant. So Europe and West Asia show a rather substantial relationship between size and power, Mesopotamia has a nearly significant relationship. South Asia, East Asia and Egypt do not have medium term temporal correlations between city sizes and empire sizes.

So we find important differences across regions. It is likely that the relationship between urbanization and political power varies over time (more below), and because of geographical and climatic differences across regions.So perhaps our findings are not surprising, but it would be helpful to have some plausible explanations for the differences that we have found.

The high correlation between the size of the largest empire and the size of the largest city in Europe would seem to fly in the face of usual notions about how Europe differs from the other regions. It is usually thought the rise of capitalism in Europe led to the emergence of large cities based on economic power and trade centrality rather than imperial capitals based on the ability to extract tribute. This might rather produce a lower rather than a higher relationship between empire and city sizes in Europe.Looking at exactly which empires and which cities were the largest enables us to know whether or not the largest cities were the capitals of the largest empires, or alternatively whether there might be regional growth-decline phases in which both cities and empires expand and contract together despite not being directly linked. Figures 3-5 (below) help us to sort this out.
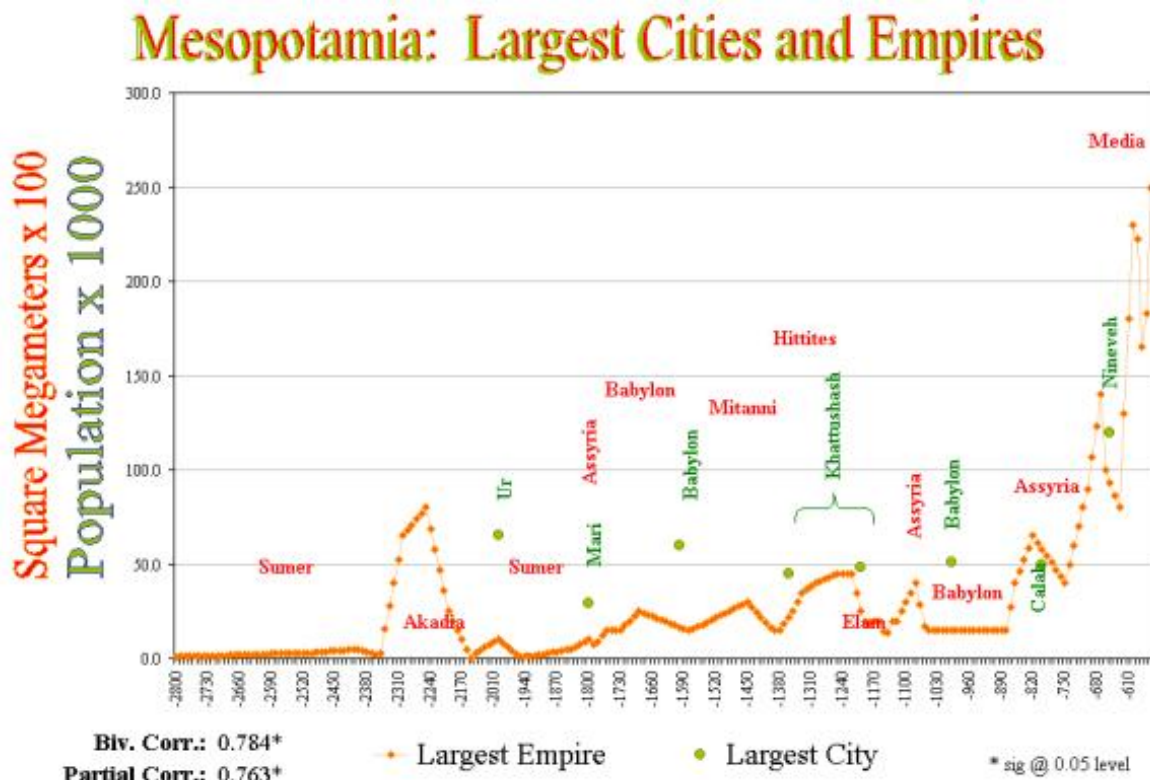

Figure3:

Largest Cities and Empires in Mesopotamia

Table 1 (above) is also helpful for discerning what is going on the Mesopotamian region. Figure 3 starts in 2000 BCE. The largest city in 1800 BCE was Mari of the Amorite state, while Taagepera tells us that the Old Assyrian state was the largest in the region at this time. It's capital, Assur, was not the largest city. The Babylonian empire conquers Mari in 1700 BCE and the city of Babylon is then listed as the largest. The Hittite Empire was large in 1360 BC and so was its capital, Khattushash (Hattusa). But the Neo-Assyrian Empire grows larger than the Hittite after 1350, while Hattusa remains the largest city, until the Hittite state again becomes largest in 1200. Then the Babylonia Empire and Babylon surpass all from 1050 to 900. Calah (Nimrud) was Ashurnasirpal II's capital of the Assyrian Empire before the building of Nineveh, so the match between city and empire is again direct from 850 to650.
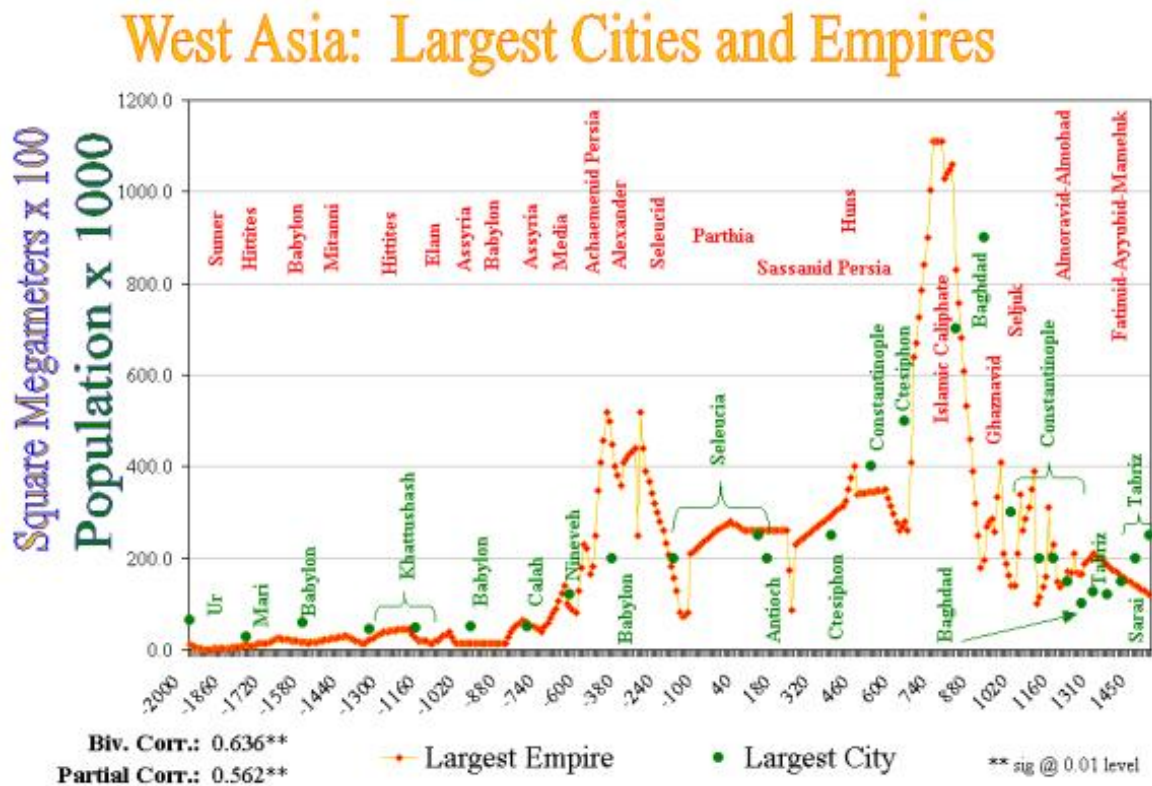

Figure 4: West Asian Largest Cities and Empires

Examination of Figure 4 shows that indeed there is usually a direct connection between the largest city and the largest empire, but there are a few exceptions in addition to those already pointed out in Mesopotamia. The Achaemenid Persian Empire did not create a new city larger than those it conquered, and so Babylon remained the largest city during the Persian expansion. The Alexandrian conquest led to the founding of Seleucia, which was then the largest city. The Sassanian Empire built Ctesiphon near in the old heartland of Mesopotamia. And the rise of Islam eventually created Baghdad in the same region. After the decline of Baghdad there was a period in which Byzantine Constantinople was larger than any of the cities of the fragmented Islamic caliphates.So the positive correlation in the West Asian region between city and empire sizes is both direct (a large empire created a large city) and indirect in that periods in which there were large cities tended to be periods in which there were large empires despite only an indirect connection.
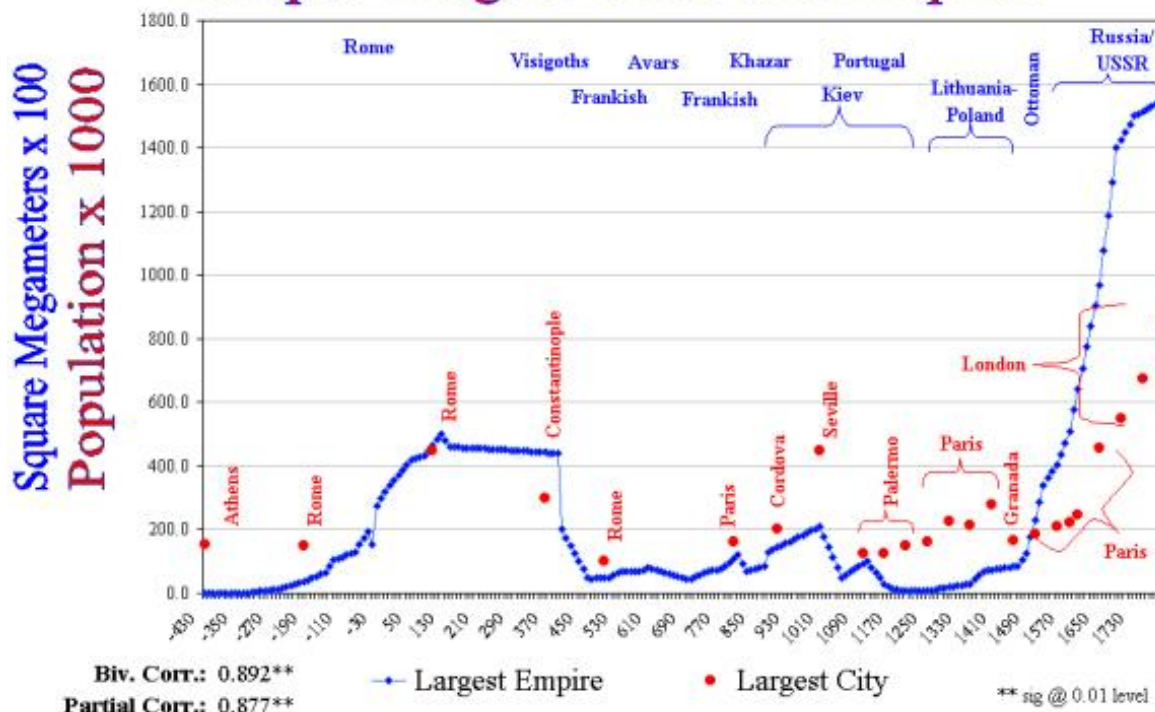
Figure 5: Largest Cities and Empires in Europe

The same kind of comparison for the region of Europe produces a somewhat different result. In Europe there is also a rather high partial correlation between largest empire and largest city (.88). And the period between 430 BCE and 850 CE shows the same kind of relationship that we saw in West Asia, where the capital of the largest empire is most of the time the largest city in the region. But in Europe we see a radical divergence from this situation after 850 CE, in which the largest city is virtually never located in the largest empire, but there is nevertheless a positive relationship between he growth/decline phases of cities and empires. The reason for this is not too hard to discover. Europe is a geographical region that developed a new form of imperialism in which relatively small European nation-states like Portugal, Spain, the Netherlands, France and England were conquering distant colonial empires in the Americas, Africa and Asia. These were large empires, and the resultant extracted riches supported the growth of the largest cities in Europe, but these colonial empires were not in Europe. Rather the largest states in Europe, as indicated by territorial size, were the Ottoman Empire and Russia. Actually if we had included Constantinople, capital of the Ottoman Empire, in our list of "European" cities then it would have been the largest city until 1800.But even with Constantinople excluded and the emergence of the colonial empires there is a positive relationship between growth/decline phases of largest cities and states in Europe. This is because the whole region went through waves of economic growth and state expansion, earlier versions of the great waves of globalization seen in the nineteenth and twentieth centuries. We have also intended to examine the relationships between polity size and city size within particular empires, but unfortunately we do not yet have enough data on city sizes within empires to make possible the calculation of meaningful correlations. Our examination of modern colonial empires looking at the territorial size of the empire and the population size of the capital city (e.g the French Empire and Paris; the British Empire and London) revealed unsurprising positive correlations and significant partial correlations despite the collapse of the colonial empires resulting from twentieth century decolonization (see Appendix B).

When we use PMNs (expanding networks of polities that ally and make war with one another), we find results that are quite similar to the those shown in Table 2. The expanding Central PMN that begins with the merger of the Mesopotamian and Egyptian PMNs in 1500 BCE reveals a bivariate correlation of .83 and a partial correlation of .59 for the period from 1500 BCE to 1990 CE. The Indic and East Asian PMNs show little or no correlation between largest cities and largest empires.

Regional Waves of Growth and Decline

Our examination of the relationships among size distributions of cities and polities did not reveal any significant associations, but our correlations between the sizes of largest and second largest cities and empires produced a rather fascinating finding. Do largest and second largest cities grow and decline in the same periods, or does the growth of one city result in the decline of adjacent large cities? In other words, is city growth a zero-sum game or are there regional boom and bust periods that affect the sizes of larger and smaller cities synchronously? And we may ask the same question of empires. Earlier work indicated (Chase-Dunn, Manning and Hall 2000) that empires tend to grow contemporaneously – periods in which the largest empire is growing tend also to be periods in which the second largest empire in growing in the same region. This would seem to be counter-intuitive, and bears further examination of both empire and city growth decline sequences.

Table 3 shows partial correlations (controlling for the long-term trend) between the largest and the second largest cities, and largest and second largest empires in each of our six regions for the same time periods used in Table 2.The number of time points is reduced in some cases where we do not have data on second largest cities or empires, and there are not enough South Asian second empires to compute a correlation.

Partial Correlations for Largest and 2nd Largest Cities & Empires for the regions, controlling for decade (trend)

	Period	City1&2	Emp1&2
Egypt	2300 B.C.E. - 550 B.C.E.	0.883*	0.438**
Mesopotamia	2800 B.C.E. - 550 B.C.E.	0.672*	0.934**
East Asia	1360 B.C.E. - 1800 C.E.	0.673**	0.662**
Europe	430 B.C.E. - 1800 C.E.	0.965**	0.882**
South Asia	600 C.E. - 1800 C.E.	0.291	data prob.
West Asia	2000 B.C.E. - 1500 C.E.	0.755**	0.239**

* sig @ 0.1 level
** sig @ 0.01 level

Table 3: Temporal correlations among largest and second largest cities and empires

The results in Table 3 are significant evidence that regions experience oscillations of growth and decline periods in which both largest and second largest cities and empires expand and then later decline. Except for South Asia, where we have only a paucity of data, all the other regions have statististically significant positive temporal correlations between city growth (and empire growth) even after the long-term trend is removed. This is strong evidence against the idea that expansion of cities and empires is a zero-sum game in which a growing city or empire takes resources or territory from adjacent cities or empires. Rather it must be processes of growth and expansion occurring synchronously within regions, as well as periods of regional contraction, that account for these relationships.

We can get a better idea about how this may be working by examining which cities and empires are growing when. Figure 6 (below) shows the largest and second largest cities in East Asia.
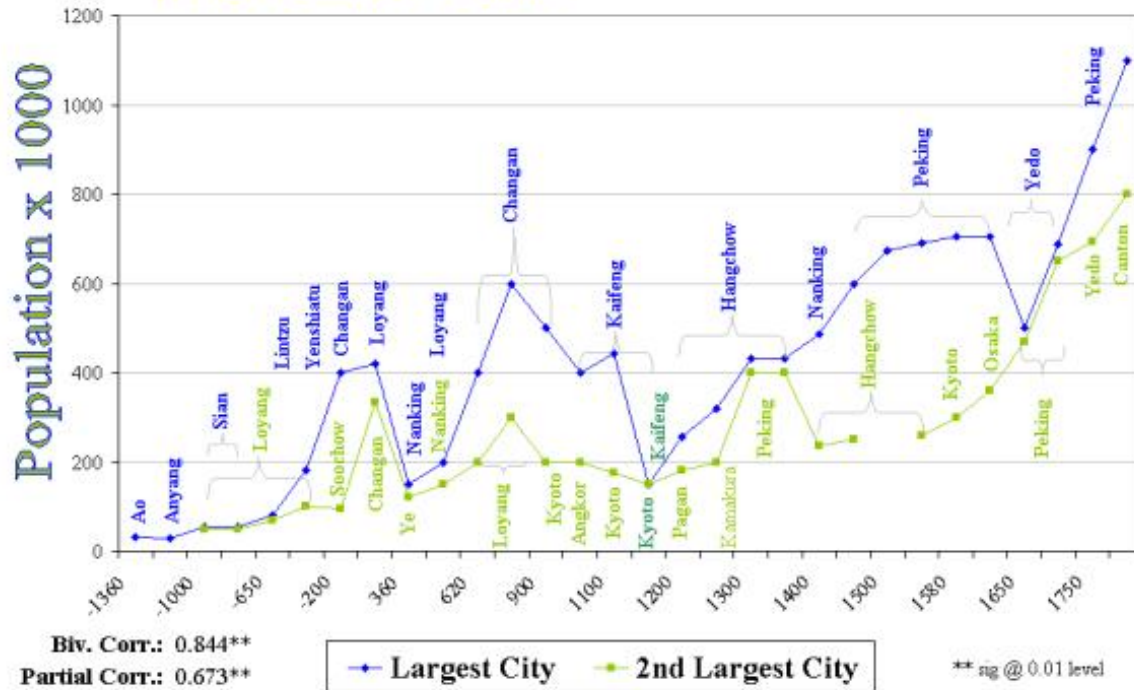
Figure 6 : Largest and Second Largest Cities in East Asia

One relevant consideration about these results that should be noted is that individual cities and empires change position when the second largest passes the largest in size. Because we are looking at ranks rather than at individual cities the resulting correlations may be somewhat larger. But Figure 6 shows that the notion of regional growth decline phases is substantiated except for the early seventeenth century CE when Peking declines while the second largest city Yedo (Tokyo) is growing. Appendix C contains graphs of the largest and second largest cities in South Asia, Europe and West Asia.

The notion of cities growing and declining in complementary phases is less difficult to accept than the idea that the territorial sizes of empires are non-zero sum. We know that tributary states vie with each other for border regions, so how is it possible that largest and secondlargest empires grow and decline together over time? Let us again examine the East Asia region, except now we will look at the empires.
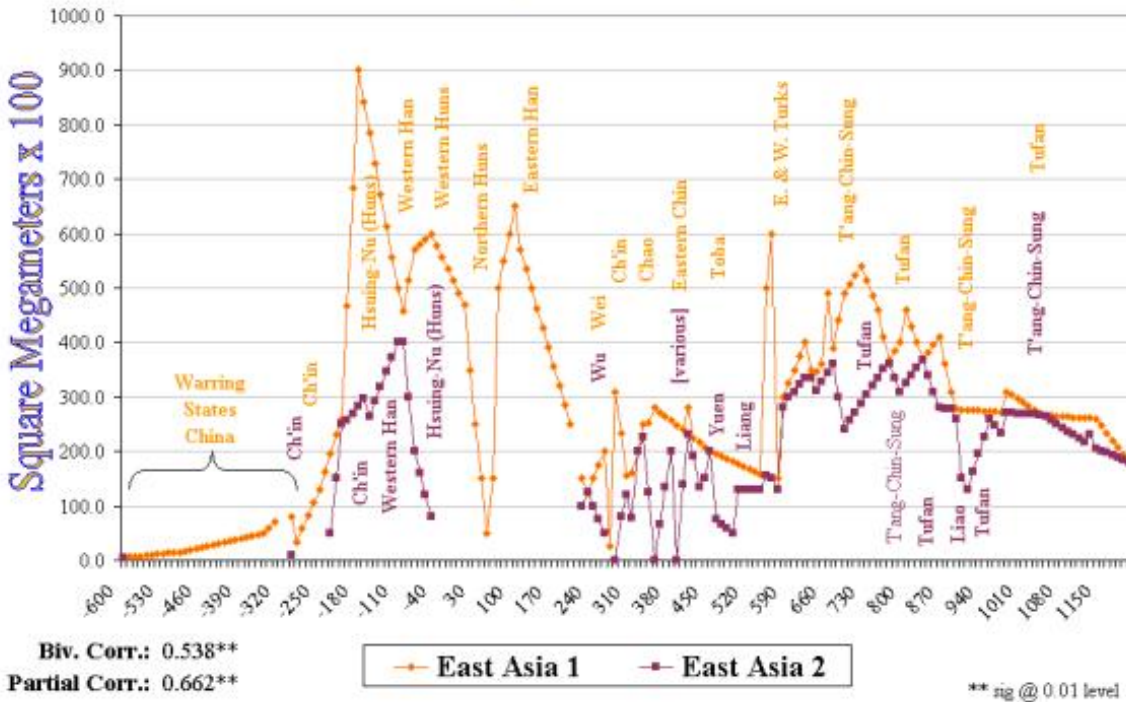
Figure 7: Largest and Second Largest Empires in East Asia

The partial correlation for largest and second largest empires is statistically significant but we can see several instances in Figure 7 in which a zero-sum interaction between competing states appears. The interaction between the Western Han and the Huns is an obvious example, and a less dramatic but similar negative interaction appears between the Tang and the Tufan. The graph ends before the emergence of the Mongol Empire because its huge size would drown all earlier variation. Appendix D contains graphs of the largest and second largest empires in Europe and West Asia.

Conclusions

We intend to do more concentrated analysis of individual empires and their cities. The results for England and France are reported in Appendix B and discussed above. More concentrated analysis will allow us to examine the sizes of more cities within polities and to consider the historical events and interactions among polities and regions.

This study of cities and empires is necessarily inconclusive because of the incomplete and unreliable nature of the data that we have on city sizes and the territorial sizes of empires. Only a strong effort to improve the existing data sets will remedy this. But we can surmise that some of the findings reported above will be reproduced once we have better data. We expect that research will continue to find important differences among regions with respect to the temporality of city and empire growth/decline phases. And we also expect that within regions there will be period differences because of changes in the relationship between demography, economic institutions and techniques of power.

The finding of significant positive medium-run temporal associations between city sizes and empire sizes in Europe and West Asia, and a smaller positive relationship in Mesopotamia is contrasted with very small but positive correlations in South Asia, Egypt and East Asia. We do not have a good comprehensive explanation for this pattern of findings. The examination of which cities and which empires are growing and declining together in Mesopotamia, West Asia and Europe suggests that this is partly due to the

positive interactions between the expansion of empires and their capital cities and partly due to the periodic nature regional growth/decline phases that affect both cities and empires. But we do not know why these factors are do not create larger correlations in Egypt, South Asia and East Asia.

The other big finding is the non-zero sum nature of the relationships between largest and second largest cities and empires in Egypt, Mesopotamia, East Asia, West Asia and Europe. For South Asia we do not have much data on second largest cities or empires. These results strongly indicate that regions go through periods of growth in which both the largest and the second largest cities and empires are growing followed by periods of decline in which these are declining together. This is especially surprising in the case of the territorial sizes of empires because we know that contending empires fight with each other over border areas and sometimes one conquers another and incorporates its territory. Though we do find instances of this kind of zero-sum interaction in the graphs (Figure 7 and Appendix D), the overall relationship is positive even when the long-term trend is taken out by computing a partial correlation that controls for time. This supports the notion that regions are behaving systemically. It is the development of economic and political interaction networks as well as the emergence of new techniques of power that are the major factors in relationships between power and size.

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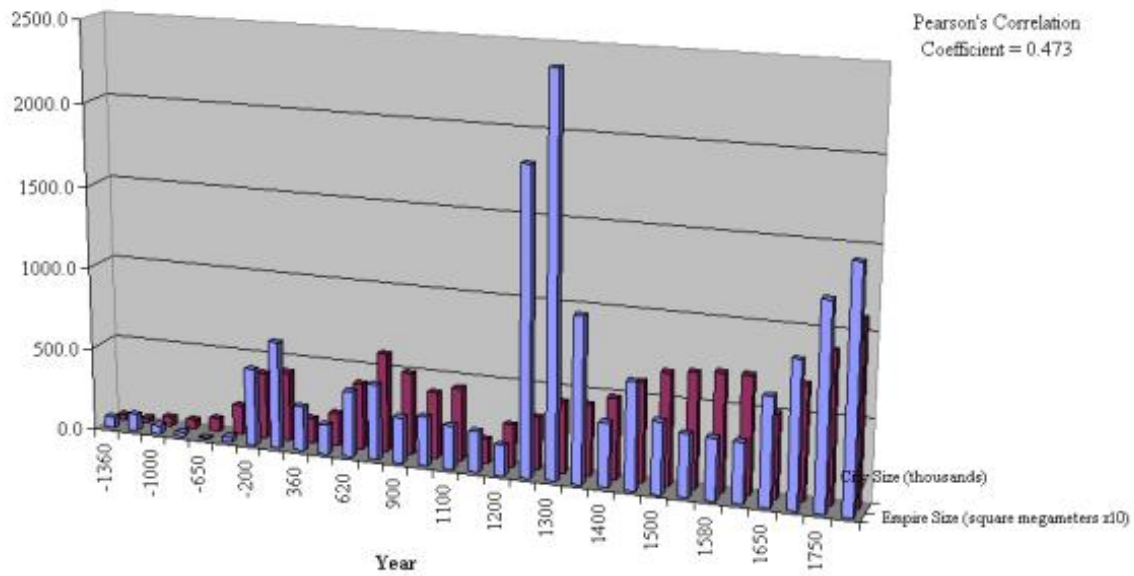the Ancient World.* Cambridge: Cambridge University Press.

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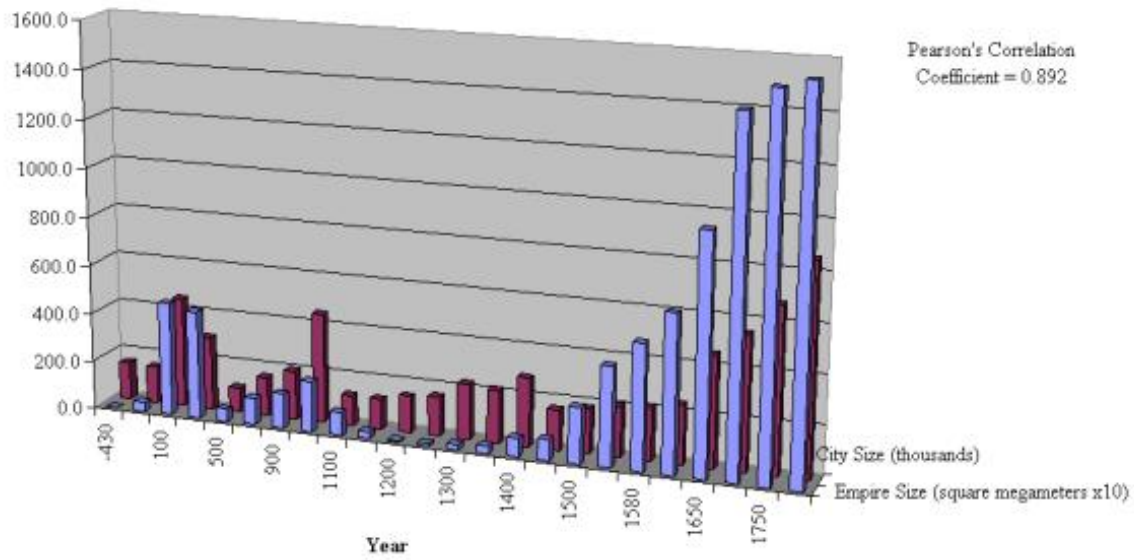_____ 1992b "Cities, civilizations and oikumenes:I." *Comparative Civilizations Review* 27:51-87 (Fall).

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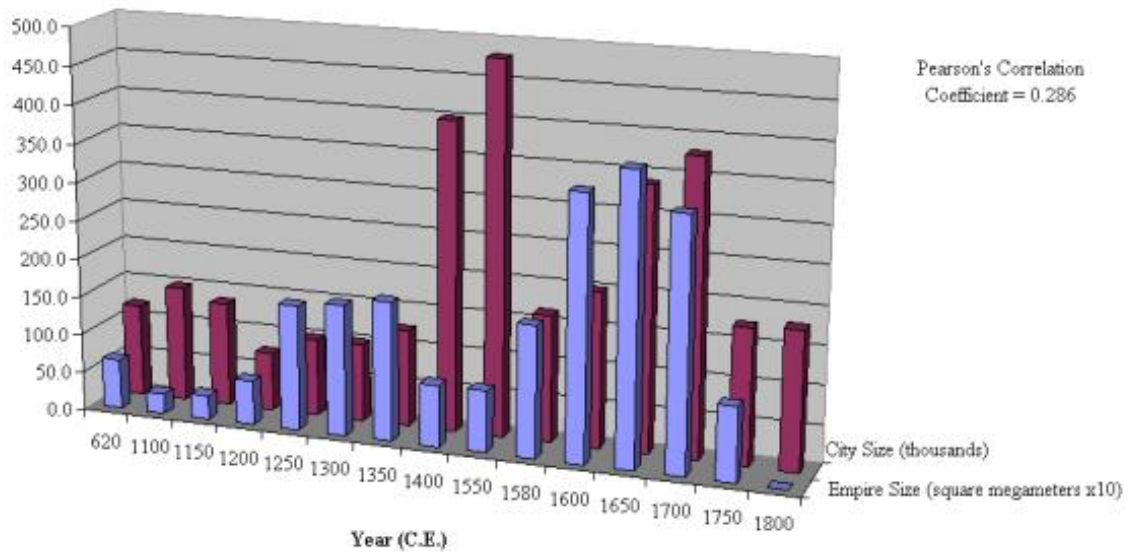Appendix A: (the following figures have been produced from the data included in Table 2.

East Asia

Europe

Pearson's Correlation
Coefficient = 0.892

City Size (thousands)

Empire Size (square megameters x10)

Year

South Asia

Pearson's Correlation
Coefficient = 0.286

City Size (thousands)

Empire Size (square megameters x10)

Year (C.E.)

Appendix B: Modern Colonial Empires and Capital Cities

England and London

Territorial Size of England/GB/UK

Natural Log of London's Population

France and Paris

Natural Log of Paris' Population

Territorial Size of France
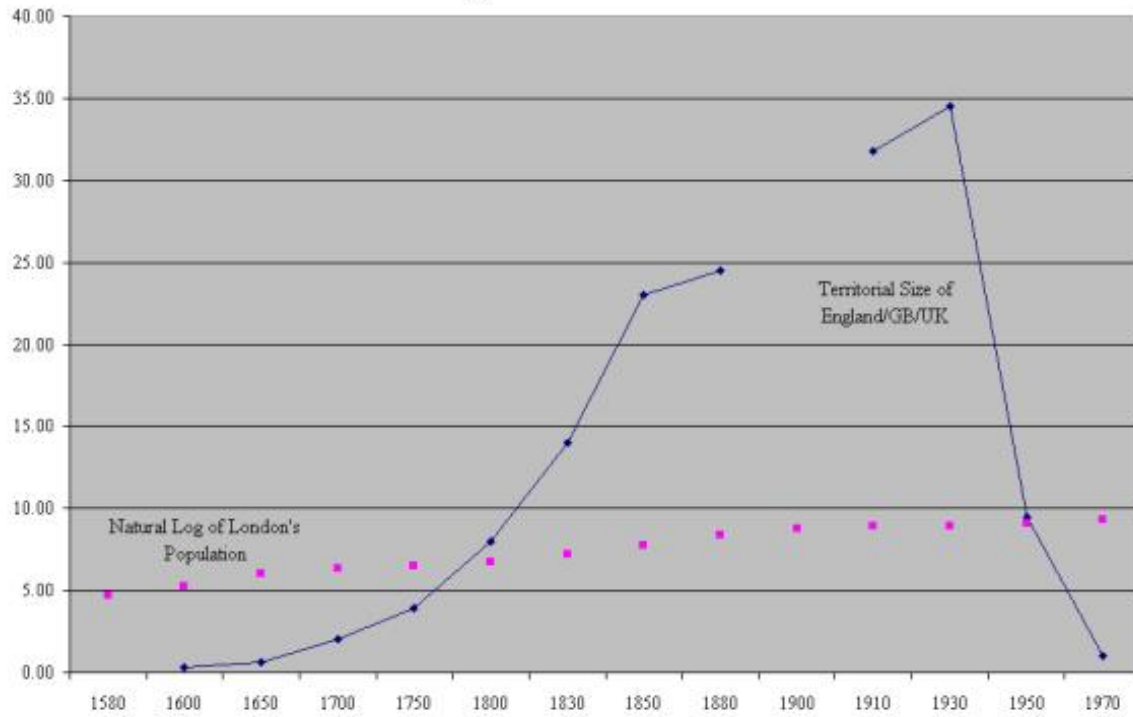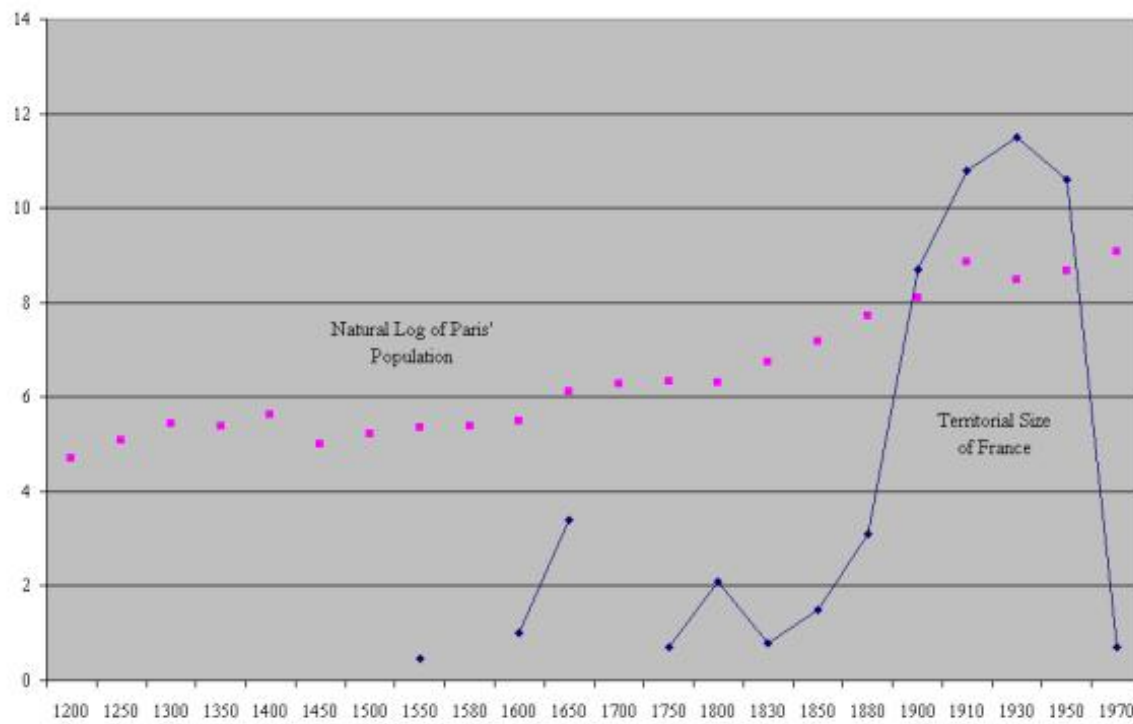
Appendix C: Largest and Second Largest Cities

European Cities

Population x 1000

London

Athens Rome Constantinople Cordova Seville Palermo Paris Paris
Syracuse Alexandria Rome Rome Seville Palermo Venice Granada London Paris
Venice Paris Venice Naples

Biv. Corr.: 0.860**
Partial Corr.: 0.851**

— Largest City   — 2nd Largest City   ** sig @ 0.01 level

South Asian Cities

Population x 1000

Kanauj
Manyakheta Anhilvada Kaylan Anhilvada Vijayanagar Bijapur Anuradhapura Ahmedabad
Anuradhapura Anhilvada Tanjore Anhilvada Kaylan Polonnaruwa Cuttack Delhi Ahmedabad Ahmedabad Hyderabad Benares
Patna Bijapur
Gaur Anuradhapura

Biv. Corr.: 0.652**
Partial Corr.: 0.291

— Largest City   — 2nd Largest City   ** sig @ 0.01 level

West Asian Cities

Biv. Corr.: 0.794**
Partial Corr.: 0.755**

Largest City   2nd Largest City

** sig @ 0.01 level

Appendix D: Largest and Second Largest Empires

European Empires

Biv. Corr.: 0.827**
Partial Corr.: 0.812**

Largest   2nd Largest

** sig @ 0.01 level

West Asian Empires

Biv. Corr.: 0.490**
Partial Corr.: 0.239**

— West Asia 1   — West Asia 2

**sig @ 0.01 level
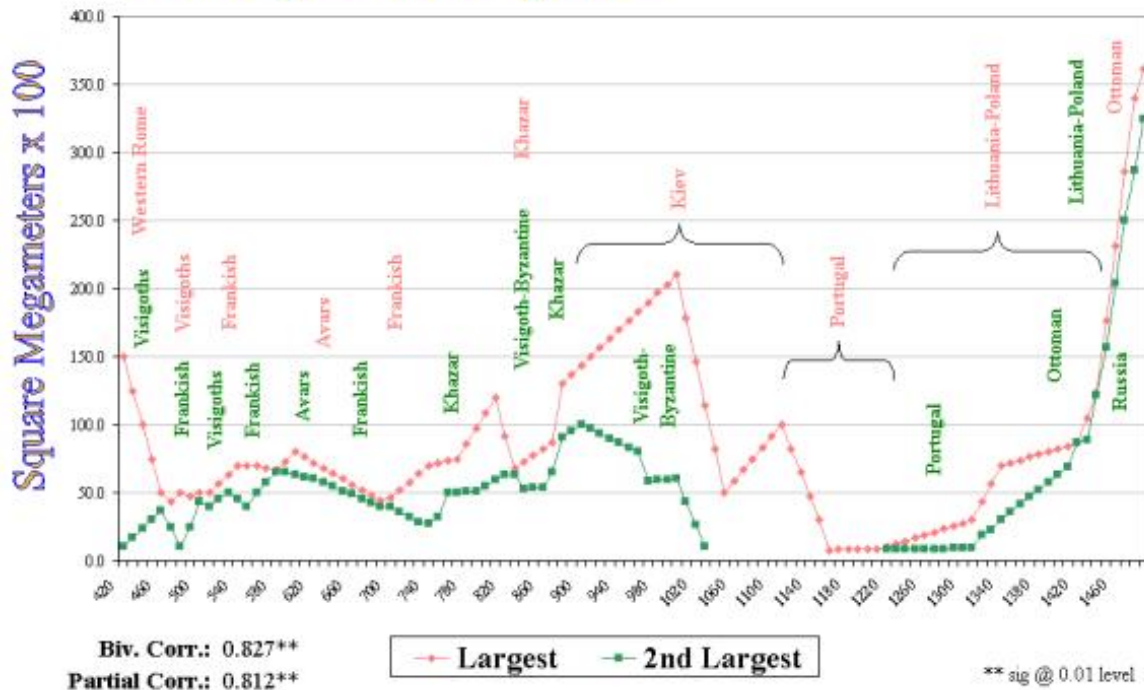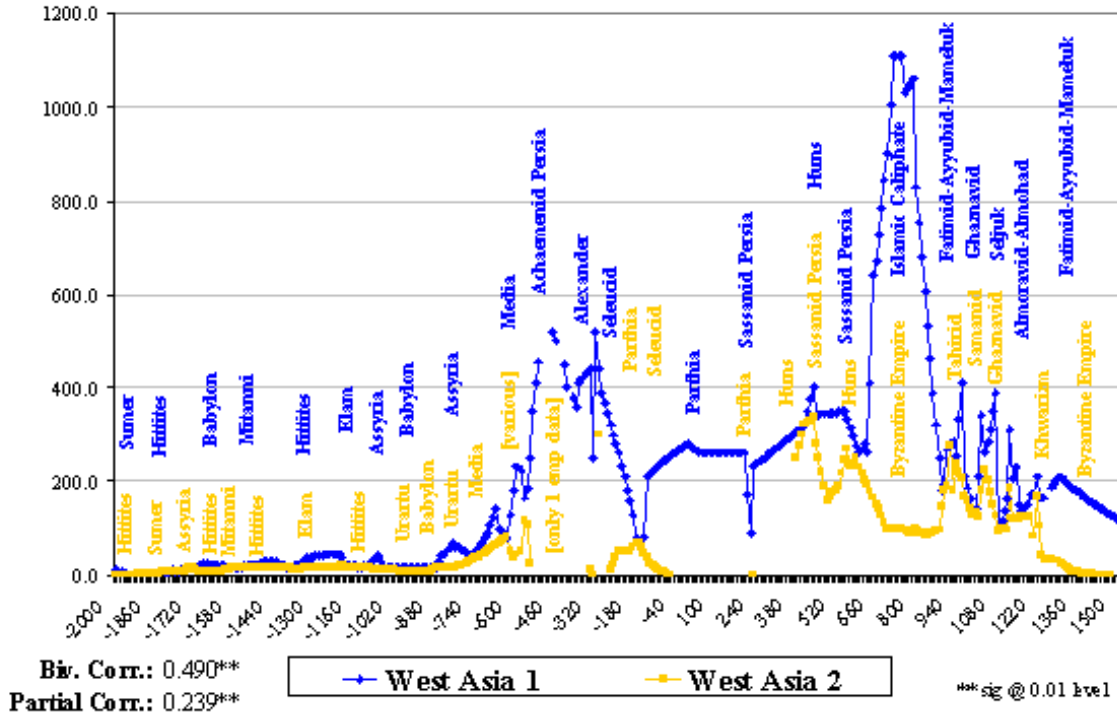
<div style="text-align:center">NOTES</div>

[1]
   This working paper is part of a collaborative project that seeks to study the processes of social evolution and historical development by comparing regional systems, and by studying changes in institutional characteristics over long periods of time. The Institute for Research on World-Systems at the University of California, Riverside(http://www.irows.ucr.edu/) is beginning the process of upgrading the earlier coding of city and empire sizes by Chandler and Taagepera. We are working in interdisciplinary collaboration with a group of scholars associated with the World Historical Systems subsection of the International Political Economy Section of the International Studies Association.

[2]
   Chase-Dunn and Hall (1997) propose a nested network approach to the spatial bounding of world-systems that includes (in order of ascending size) bulk goods nets (BGNs), political/military nets (PMNs), prestige goods nets (PGNs) and information nets (INs).

[3]
   In order to indicate our sympathy with the efforts of world historians to escape from Eurocentrism, we employ the conventions BCE (before common era) and CE (common era) to delineate time.

[4]
   The exponential growth of cities after 1800 CE makes it more difficult to study growth/decline phases because the largest cities no longer decline in size. This problem can be overcome by studying changes in the rate of growth.

[5]
   The regions we will study are:
      1.Mesopotamia, including the drainages of the Tigris and the Euphrates.
      2.Egypt, the lower valley of the Nile.
      3.Europe, including the Mediterranean and Aegean islands, that part of the Eurasian continent to the west of the Caucasus Mountains, but not Asia Minor (now Turkey);
      4.Africa;
      5.West Asia including Asia Minor, Mesopotamia, Syria, Persia, the Levant, and Bactria (Afghanistan).
      6.South Asia including the Indus river valley;
      7.East Asia, including China, Korea and Japan and Southeast Asia, but not Indonesia;

[6]
   See http://irows.ucr.edu/research/citemp/citemp.html . For a fascinating animation of the territorial expansion of the Mogul Empire in South Asia after 1500 CE see http://ecai.org/projects/ProjectExamples/SouthAsianAnimations.html

[7]
   Indeed the recent sharp upturn in city sizes since 1800 CE is the reason why we end our analyses in that year. Including the years after 1800 would dwarf variation in earlier periods. This can be remedied statistically by logging the city population sizes.