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The World System, Regional Systems, and the Limitations of Historical Urban Population Datasets

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Abstract

This study presents a method for mapping and comparing the regional extents of historical city-based economies at the global scale by integrating the World-Systems Theory of Immanuel Wallerstein with the Regional Systems Theory of G. W. Skinner. The approach taken here focuses on mapping urban cores and their rural peripheries based on available disaggregated urban population estimates for 1741 cities according to six main historical periods from ca. 3700 BCE to 1900 CE. As a result, a spatial history of some regional-scale changes wrought by increasing modes of capitalism in the Modern and Industrial periods may be compared with earlier patterns.

Keywords; World Systems Theory, Regional Systems Theory, Historical Demography, Cities, Historical GIS

Introduction

This study proposes a new methodology for mapping historical World Economies, and their modern integrations into one Global Capitalist Economy, based on the World-Systems Theory of Immanuel Wallerstein (1974, 1975) and the Regional Systems Theory of G. W. Skinner (1985). The purpose of this endeavor is to compare historical city-based regions of trade and marketing across different societies and civilizations. Many economists consider population density the best measure of the level of technological advance of economies before 1800 (Allen 2011, Combes et al 2008). These spatial differences can be compared and measured at regional scales since the Bronze Age and maintain relevance into the modern period characterized by the development and spread of a Global Capitalist Economy.

To illustrate these points, the best available GIS dataset of historical urban populations will be utilized to map the varying extents of regional economies over the course of recorded human history according to Regional Systems Theory. These data were harmonized by Reba et al (2016) from “Four Thousand Years of Urban Growth: A Historical Census”, by historian Tertius Chandler (1987), and “World Cities: -3,000 to 2,000”, by political scientist George Modelski (2000, 2003).

Unfortunately, the sparse nature of the available historical urban census data with incomplete and missing population estimates requires mapping patterns according to six broad, general periods ca. 3700 BCE to 1900 CE. As a result, only a general delineation of the largest regional economies is discerned across historical cultural landscapes, though some new insights are provided in how these regional networks of trade and commerce formed historical World Economies that became more integrated into one dominant World-System over time.

Regional Systems Theory focuses on how the historical agrarian-based marketing systems of societies formed regional economies that conditioned aspects of culture, such as demography. Regional Systems Theory also examines how traditional peasant economies and societies changed as they ultimately evolved into industrial political economies.

This problem also forms the crux of World-Systems Theory with its main tenet that a Modern Capitalist Economy arose in Europe in the sixteenth century and led to European hegemony over a single World-System that connected more and more peoples and their regional economies together through trade, migration, and investment. Before this period, there was no single World Economy but instead many regional economies, or what Skinner termed “macroregions”, based where the circulation of food and everyday raw materials was largely self-contained in rural to urban networks defined by bulk-good exchanges due to the limitations of pre-mechanized transportation, but with some interaction with other cultures and civilizations through long-distance trade.

Wallerstein’s approach is largely qualitative, while Skinner based the validity of his theory on quantitative findings from historical geographic information systems (HGIS) models of entire states and civilizations. The idea that historical groupings of macroregional economies provided the material basis for societies and civilizations was proposed by Fernand Braudel (1981-1984), a key figure of the *Annales* school of history, using the term *économie-monde* (World Economy) to define those economically autonomous parts of the world. Historical take-overs of multiple macroregional economies by larger political-military networks contributed to common forms of cultural practices that helped to shape civilizations, such as Rome’s contribution to Classical Civilization, and the Han dynasty’s contribution to Chinese Civilization. In such cases, however, broader cultural commonalities among multiple macroregions of the same civilization owe far more to common agricultural systems related to climates and watersheds, and also geographically isolating factors such as oceans and mountain ranges, than they do to more recent and shorter-lived periods of common political-military domination.

Only with great effort were these regional flows supplemented at particular times and places with bulk-good connections between multiple macroregional economies, such as the Romans achieved with Egyptian grain shipped across the Mediterranean, and the Chinese with grain moved along the Grand Canal from the Lower Yangtze to North China.

The striking complementarity between Skinner's Regional Systems Theory and Immanuel Wallerstein's World-Systems Theory can be seen in several similar general rules:

1. The changing geographical extent of World Economies over time
2. The dominance of major urban centers over their hinterlands within each regional economy, and
3. The hierarchical nature of the nested core-periphery zones.

World-Systems Theory, as it has been articulated so far, however, only provides a generalized mapping according to modern state boundaries. Regional Systems Theory, on the other hand, provides spatial detail on how marketing systems connected urban centers with rural areas, and the historical socioeconomic transformations in human culture that occurred when the Modern Capitalist World-System spread and integrated disparate World Economies.

Another key difference between World-Systems Theory and Regional Systems Theory, lies in the focus of the latter on the marketing of economic surplus directly from peasant production and how these forms of commercialization affected social processes according to location within World Economies defined largely by civilizational factors, while Wallerstein considers the narrative of greater interest once proletarians subsisting on their wage labor arose in different parts of a single Global Economy.

When this happened, largely due to industrialization initially in Europe, a greater power hierarchy started to operate between urban "core" states, and more rural "periphery" states in which these powerful and wealthy capital-intensive core societies could dominate and exploit weak and poor labor-intensive peripheral societies.

Wallerstein, however, generalizes about the historical geography of these socioeconomic changes over centuries by placing entire nations and societies into abstract, spatially undifferentiated developed cores or less developed peripheries according to modern state boundaries. In reality, vast regions since ca. 1500 were beset by uneven development caused by imperialism, colonialism, and capitalism. Some people profited from commercialization side-by-side with peasant subsistence producers.

There also exist today historically enduring internal core-periphery geographies within each of Wallerstein's theoretical cores and peripheries, such as the Celtic Fringe of British national development, and Native American Nations within the United States. This study will illustrate how mapping actual core-periphery geographies of societies and economies over time using Regional Systems Theory offers greater detail and accuracy in discerning and quantifying the rise and spread of the Modern Capitalist World System.

World and Regional Systems Theories: A Comparison

World-Systems Theory was developed by Immanuel Wallerstein (1930-2019) to explain contradictions in classical modernization theory that posited similar stages of development for all states and cultures while ignoring how global capitalist markets and commerce exploited weaker states.

Inspired by Marxist economic theories, Wallerstein focused on how capitalism grew from European roots after about 1500 into one global market system beyond the power of national political regimes to control and spread to subjugate the entire world largely for the benefit of the West by the twentieth century. Wallerstein (1974) published the first major articulation of World-Systems Theory in his seminal paper "The Rise and Future Demise of the World Capitalist System: Concepts for Comparative Analysis."

Subsequently, Wallerstein (1975) published "The Modern World System I: Capitalist Agriculture and the Origins of the European World-Economy in the Sixteenth Century," which is widely considered Wallerstein's landmark contribution to sociological and historical thought, triggered numerous reactions, and inspired many others to build on his ideas (Martínez-Vela 2001).

In relation to this present study that examines World-Systems Theory across time and space, it is useful to consider the summarization of the views of world historians vis-à-vis Wallerstein according to Abu-Lughod (1993):

1. Wallerstein espouses the view that there has only been one World-System, the one that began with the sixteenth century.
2. Abu-Lughod argues that there have been several successive World-Systems, each with a changing structure and its own set of hegemons.
3. Frank and Gills (1993) argue there has only been a single World-System that has continued to evolve over the past 5,000 years.

These different views are each correct according to their own definitions and it is not possible to disprove any because the work of Wallerstein, and those of his followers, is largely qualitative and does not engage with HGIS databases, spatial analysis, and cartography to map changing extents of regional and world economic systems over time. Hence, world historians and World-Systems theorists lack agreed-upon methodologies for measuring how trade and marketing networks produced regional economies over time, unlike the quantitative spatial methods developed in Regional Systems Theory for mapping and defining macroregional economies at given points in time based on available disaggregated historical census and related data.

Regional Systems Theory was pioneered by the anthropologist G. W. Skinner (lived 1925-2008) to map and measure the effects of economic systems on social and cultural processes over the nineteenth and twentieth centuries (Skinner 1964, 1965, 1985). Skinner's oeuvre focuses on applications of his theory and methods to explain how demographic processes and cultural institutions were largely conditioned by the trade and marketing systems of macroregional economies in China, France, and Japan.

In fact, Skinner's efforts led to the first historical instances of national-level Historical GIS (HGIS) databases being built and utilized for research during the 1980s and 1990s for these research projects. Skinner, however, did not refer to his methodology as HGIS because the term was not coined until the 1990s, and consequently his efforts have not been recognized as such. But when the new field began to take shape from different disciplines in the 1990s, early proponents quickly recognized how well-suited the project was for the study of regional economic growth and change (Healy and Stamp 2000).

Despite a great amount of effort exerted by Skinner over the 1980s through the early 2000s in working on comparative macroregional systems case studies of nineteenth century China, France, and Japan with the support of large grants and specialized workshops, only his work on China and Japan resulted in formal peer-reviewed publications (Skinner 1993, 1994; Skinner, Henderson, and Yuan 2000; see also Henderson 2013). The work on France, in contrast, can only be studied now by reading Skinner's relevant unpublished grant proposals, conference papers, and lectures (Skinner 1988, 1991). Furthermore, Skinner's archived statistical and GIS datasets for France is in disarray compared to his more polished China data available online for the late imperial and PRC periods, and a recent Beta-version of his Japan data (Henderson and Berman, 2016).

Recently, a HGIS teaching manual has been published, and subsequently discussed in detail, by Ryavec and Henderson (2017, 2018), two former students of Skinner, introducing how to apply the main tenets of Regional Systems Theory. This manual focuses on teaching GIS techniques required to replicate Skinner's regional systems models and findings with his historical GIS datasets of France and China.

In these HGIS exercises, the nineteenth century urban systems of France and China are mapped in relation to population densities, and then compared to navigable waterways. A final exercise compares late nineteenth century urban population densities between the two countries.

There was also a shift in Skinner's refining of Regional Systems Theory over the 1990s to a focus on China's contemporary demographic structure due to the accuracy of China's 1982, 1990, and finally 2000 censuses compared to the largely inaccurate and spatially incomplete historical data on Chinese society. Though there are isolated cases of demographic data for various small areas in China historically, there are no accurate data offering complete spatial coverage of China prior to the 1982 census. Available data from China's 1953 and 1964 censuses offer less detailed demographic information than the later censuses and were also subject to Maoist period data rigging and manipulation.

Skinner (1987) published key findings on this problem pertaining to nineteenth century population data from Sichuan, where he found that while imperial concern and pressure may have led to short runs of empirically based reports, the reporting system quickly reverted to the systematic fabrication of data. The telltale signs of such fabricated data series are invariant population growth year after year coupled with growth rates that steadily and regularly decline. For this reason, only Skinner's research on France and Japan included the analysis of pre-twentieth century macroregional systems of the entire countries based on demographic variables, such as fertility. In his study of dynastic China, mainly during the late Qing period, Skinner based his macroregional systems analysis largely on estimates of the size and importance of urban centers.

It is mainly due to this reason that Skinner focused on contemporary China in his late research and justified it to some extent by arguing that China retained important traits of a mature Eurasian peasant economy as documented in the 1982 census, and to varying extents in the 1990 and 2000 censuses. Skinner believed the rigid household residency (Chinese: *Hukou*) requirements of the Maoist period, still largely retained by 1990, allowed the traditional rural-urban characteristics of Chinese civilization to be studied and compared with modern census data along with recent changes due to economic modernization, such as in rail transportation.

In contrast to the largely qualitative Marxist approach of Wallerstein to uneven development due to the expansion of a European capitalist mode of production from the 16th century onwards, Regional Systems Theory utilizes classic Land Use, Central Place, and Time Geography Theories to quantitatively map and measure how trade and marketing conditioned the human geography of traditional peasant societies.

The historical legacy of spatial unevenness in trade and marketing in premodern agrarian economies, due in part to the limitations of pre-mechanized transportation technologies, resulted in systematic areal differences in culture and demography, such as in life expectancy, fertility rates, and family systems.

Skinner's approach is often characterized as "Macroregional Systems Theory" due to its detailed mapping of economic and demographic processes in relation to densely settled urban cores centered on apex cities and their agrarian hinterlands. The advantage of this approach for world-system and world history theorists lies in its ability to construct and analyze detailed HGIS models of societies, settlement systems, and economies so that a more detailed spatial history of changes wrought by increasing modes of capitalism in the Modern Period may be mapped and compared with earlier patterns.

Criticism of Skinner's Regional Systems approach largely stem from concern that as a spatial model it fetishizes the traditional marketing systems of peasant societies according to geometric zones of urban and rural land use and is unable to consider impacts from increasing modes of capitalist accumulation and global investment in the Modern Period (Szymanski and Agnew 1981, Cartier 2002).

However, much of these lines of criticism ignore that forms of quantification in Regional Systems Theory, specifically its use of HGIS databases, are actually necessary for both testing hypotheses and the generation of new knowledge in historical economic geography. This study argues that constructing and utilizing HGIS datasets can advance both theory-based understanding of impacts from marketing and trade on entire civilizations and societies and changes wrought since the 16th century by the rise of a Global Capitalist Economy, instead of the mere generalizations produced by theoretical tropes.

In conclusion, it might be useful to apply the classic parable of the blind men and an elephant to compare Skinner's and Wallerstein's efforts to describe how historical World Economies functioned and became more integrated over time. Each approach offers an accurate assessment of a part of the historical World-System. In Skinner's case, the impacts of urbanization and marketing on demography and social structure are explained and mapped in detail for the historical macroregional economies of China, France, and Japan according to both traditional peasant systems and increasing modes of industrialization. Wallerstein, in turn, explains how and why capitalism developed and spread after about 1500 CE, and impacted historical world economies. Combining these two approaches will facilitate the development of a global historical model of capitalism that includes local and regional-scale data to compare and quantify how cultures and societies changed from agrarian-based economies to integral parts of a Modern World-System.

Previous Research

To date, there has been no attempt to map and measure the areal core-periphery extents of historical regional and world economies, and their integration into a Global Capitalist Economy, according to the specific methodology of Regional Systems Theory with its heavy reliance on Geographic Information Science. There are, however, some related mapping attempts worth outlining for better understanding the background to this current study.

Wilkinson (1991, 1993) determined there are fourteen civilizations that formed historical World-Systems based on “collections of interacting cities,” or what Braudel called “World Economies,” based on established criteria by classic civilizationists such as Quigley (1961) and Toynbee (1934-1961): cities, record-keeping, economic surplus, non-producing classes, etc.

These civilizations are Mesopotamian, Egyptian, Aegean, Indic, Irish, Mexican, Peruvian, Chibchan, Indonesian, West African, Mississippian, Far Eastern, Japanese, and Central. The spatial histories of these ideal-type civilizations are characterized by urban cores, semi peripheries, and weakly connected peripheries.

Wilkinson produced chronographs charting the historical integrations of these World-Systems into what he termed one “Central Civilization” after ca. 1500, which may also be considered part of the basis of Wallerstein’s Modern Capitalist World-System. In addition, Wilkinson drew nine maps of the approximate areas of the core and periphery of Central Civilization for periods ranging from 825 BCE to ca. 1990 but provided no data and methodology for how these spatial zones were determined other than referencing a series of Penguin historical atlases of world history.

Nevertheless, Wilkinson’s roster of fourteen major civilizations is frequently mapped and discussed in the World-Systems and world history literature, and for this reason offer useful comparisons for the core and periphery zones of historical world economies mapped and analyzed in the findings section of this study below.

Chase-Dunn and Hall (2011) define regional economies prior to the emergence of a Global World-System in the nineteenth century as varying “spatially nested interaction networks,” and the smallest of these they term “bulk goods networks” which can be equated with the Skinnerian macroregion. Bulk goods networks could be encompassed by larger political-military networks, and these by even larger networks in which prestige goods and information flowed. The works of these World-Systems theorists over the past decades is largely based on graphing estimated sizes of cities over time, with the goal of identifying systemic patterns such as cycles of growth and decline (Inoue et al 2015).

Unfortunately, these calculations of spatial expansions and contractions of different city networks over time do not identify and measure the areas of urban cores and their rural peripheries, and other key features such as cores developed along coastal regions. These attributes, detailed in the findings section below, are key to determining when World Economies arose historically, and became part of one single Global World-System.

To summarize, these previous studies merely offer a general conclusion that Western political-military networks of the nineteenth century caught up with the world's prestige goods networks such that in the twentieth century the bulk goods network became global. What is missing from this scholarship is a theoretically informed methodology to map historical World Economies and measure the extents to which they survive and have also changed as part of a single Modern Capitalist Economy or World-System.

Data

A global historical GIS database of city locations, and estimated urban populations at different points in time, provided the data for this study on mapping the history of regional and World Economies (Figures 1 – 6). These data were harmonized by Reba et al (2016) from “Four Thousand Years of Urban Growth: A Historical Census”, by historian Tertius Chandler (1987), and “World Cities: -3,000 to 2,000”, by political scientist George Modelski (2000, 2003). Chandler included only cities with populations over 20,000 from 800 to 1850 CE, except for Asian cities which had a 40,000 population threshold for this period. A total of 1,599 geolocated cities are in Chandler's work for the entire time period, based on estimates from a wide range of sources, such as censuses, travelers' diaries, and tax documents.

Based on these sources, Chandler determined a demographic factor for each particular city (such as from the number of loaves of bread sold) and then applied a relevant multiplier to create urban population estimates for specific years. Modelski subsequently built upon and extended Chandler's work by focusing on urban settlements from 3500 to 1000 BCE, and by using different minimum thresholds for different periods:

1. Ancient (3500 to 1000 BCE): 10,000 or more inhabitants
2. Classical (1000 BCE to 1000 CE): 100,000 or more inhabitants
3. Modern (1000 CE onward): 1,000,000 or more inhabitants.

Modelski also augmented Chandler's dataset with additional historical sources, and selectively applied rank-order principles (also known as Zipf's Law or the Power Law) to estimate more historical city sizes.

Despite the different sources and methodologies Chandler and Modelski employed in their historical city population estimates, their two volumes are the only global-scale compendiums of urban population pre-1950.

The harmonized dataset contains 1,741 unique city entries, and 10,352 unique city/data/population values. Each city was initially georeferenced using a single, central latitude and longitudinal point by using the online geocoding platforms of *CartoDB*, and *Google Places API*. Next, the *GeoNames* database was used to improve upon the online geocoding results. The resulting harmonized data list a primary Romanized name for each city, and an alternate spelling(s) if any. In addition, the contemporary state where each city is located is listed for reference.

Owing to the complexity of mapping the changing geographical extents of regional and World Economies over the entire course of recorded human history, these historical city data have been aggregated into six main historical periods to facilitate this initial mapping and identification project:

1. Ancient; 3700 - 500 BCE, 96 cities (Figure 1)
2. Classical; 499 BCE – 500 CE, 104 cities (Figure 2)
3. Medieval; 501 – 1200 CE, 304 cities (Figure 3)
4. Early Modern; 1201 – 1500 CE, 350 cities (Figure 4)
5. Mercantilist; 1501-1800 CE, 648 cities (Figure 5)
6. Industrial; 1801 – 1900 CE, 1287 cities (Figure 6).

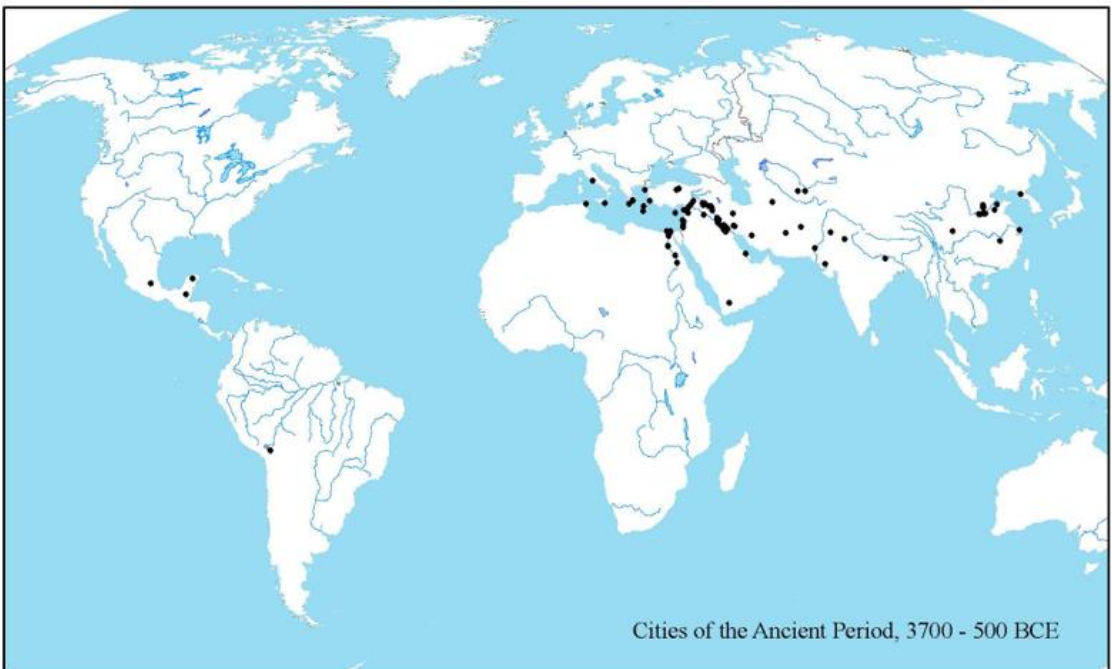


Figure 1: Cities of the Ancient Period, ca. 3700-500 BCE

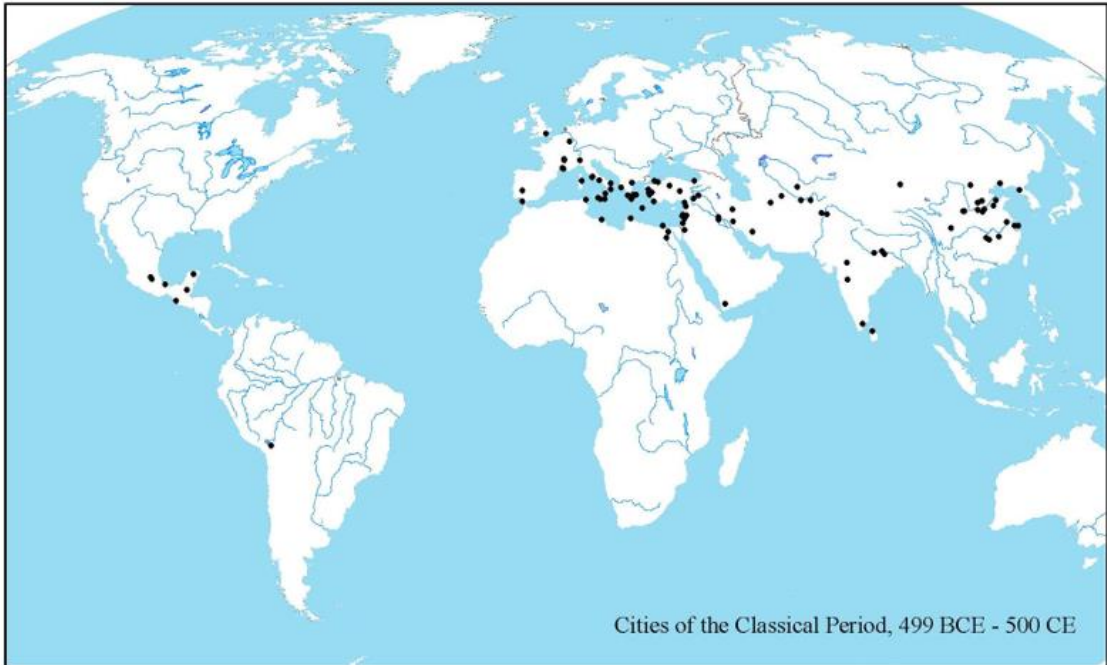


Figure 2: Cities of the Classical Period, ca. 500 BCE – 500 CE



Figure 3: Cities of the Medieval Period, ca. 501-1200 CE

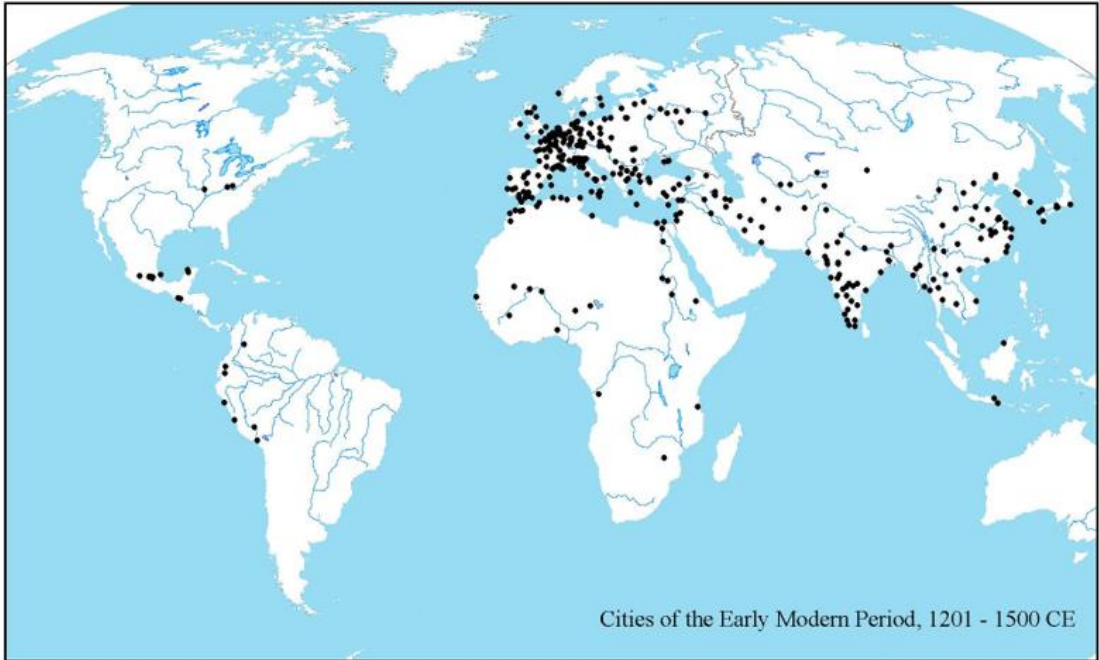


Figure 4: Cities of the Early Modern Period, ca. 1201-1500 CE

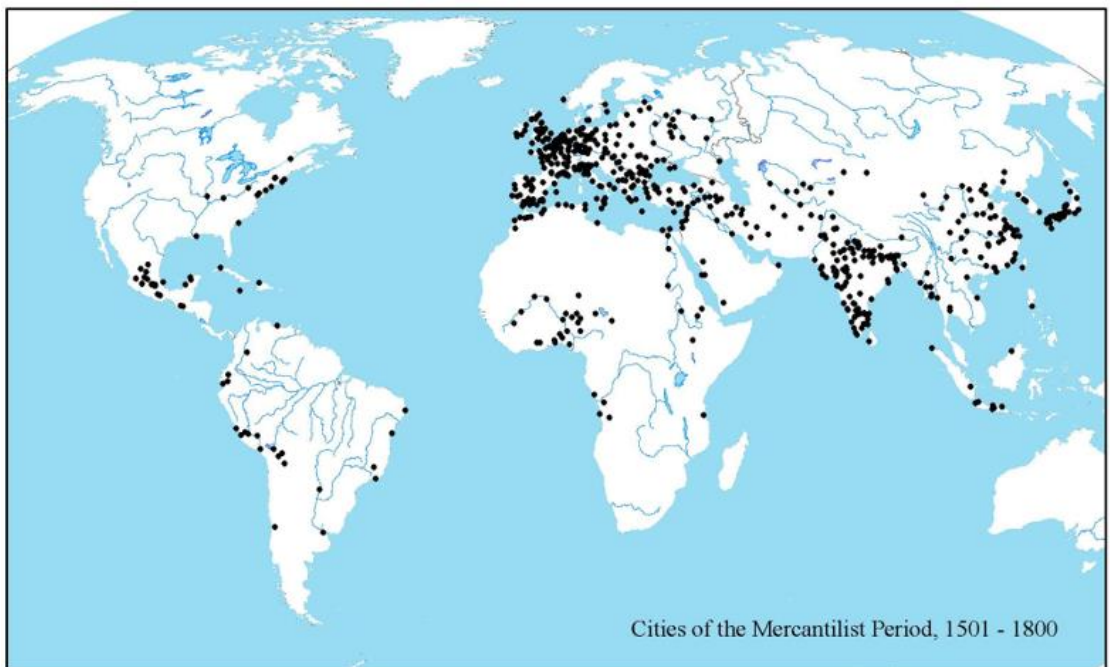


Figure 5: Cities of the Mercantilist Period, ca. 1501-1800 CE

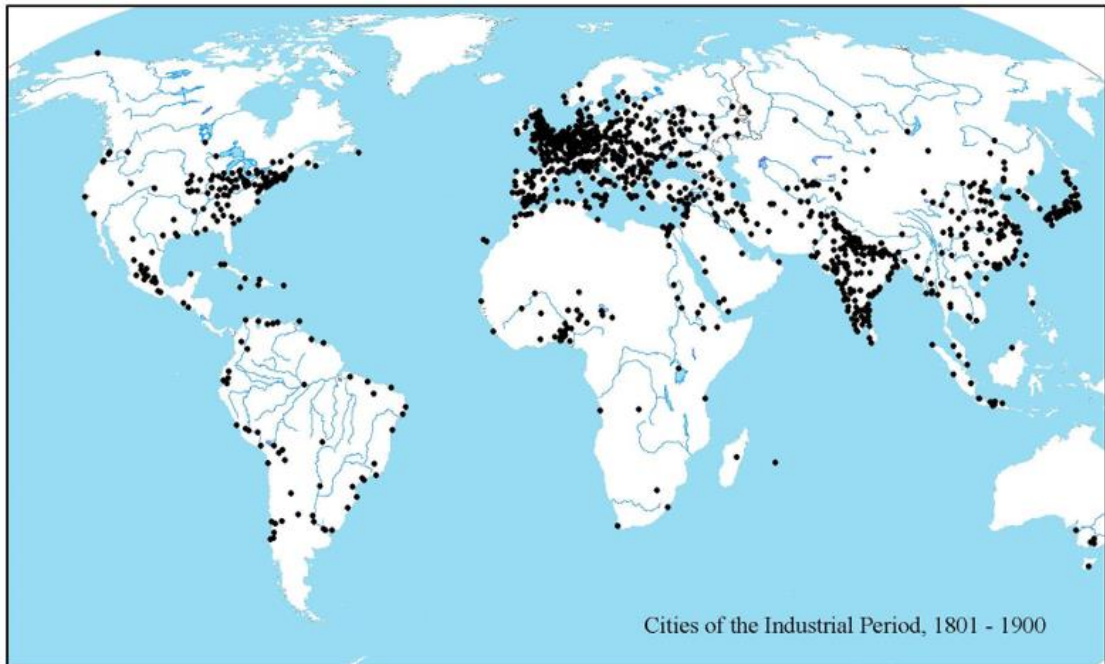


Figure 6: Cities of the Industrial Period, ca. 1801-1900 CE

Methodology

Based on the 1,741 unique cities georeferenced in the harmonized dataset by Reba et al (2016), median urban population estimates were analyzed for 2,789 city entries according to the six historical periods with 1900 CE as a temporal endpoint. The Kernel density function of ArcGIS (ESRI, Redlands, California) was utilized to map the density surface of urban population distributions by period. For any point in space, the Kernel density estimator searches the neighboring city sites within a predefined distance range or bandwidth. A value of 300 km was used for this bandwidth function.

Each city was also weighted by the median estimated urban population for the specific time period so that the search neighborhood included in the density estimation is determined by a mathematically defined kernel function with higher weights given to cities with larger populations.

The urban population densities are mapped in four zones (Skinner typically identified between 7 and 14 zones for a given region), though there is no specific number of zones required.

But too few zones would not allow the cores of regional economies, or macroregions, to be identified within cultures and civilizations, while too many zones would spread the highest density values over a multitude of zones making it difficult to discern the cores of macroregions and World Economies.

These four zones range from an innermost core to an outermost periphery and were mapped based on the Natural Breaks method of Jenks (1967). The Jenks optimization method is also known as the goodness of variance fit (GVF). It is used to minimize the squared deviations of the class means. Optimization is achieved when the quantity GVF is maximized.

Specifically, these zones are labelled for heuristic purposes as the Inner Core, Outer Core, Near Periphery, and Far Periphery. For each historical period, the core-periphery zoning reflects core areas of estimated urban population densities as proxies for economic activity relative to the data itself.

Thus, comparisons between periods are not based on absolute numbers, but rather values that reflect areas of dense urban settlement relative to each period. To better illustrate this point, consider that the Inner Core population densities in the Ancient Period ranged from 2.5 to 4.7 persons per square kilometer. By the Industrial Period, the density values in the Inner Core increased to 21.1 to 54.5 persons per square kilometer. If the natural breaks method was not utilized to map population density ranges relative to each period, large regions would perforce be labelled as the Inner Core by the Industrial Period, and the significance of relatively higher core-like densities only found by then in Europe and North America might go unnoticed.

Findings

The core areas of regional and World Economies are identified based on the highest estimated urban population densities, termed the Inner Core, mapped during each historical period (Figures 7 – 12). Lower levels of urban population densities are mapped, in decreasing order, as the Outer Core and Near Periphery. Note that the Far Periphery, by default, covers the entire world not otherwise defined as one of these three higher-level zones. This approach will facilitate a concise, yet complete, historical survey of the largest macroregional economic systems for global comparisons.

The Ancient Period, ca. 3700 - 500 BCE

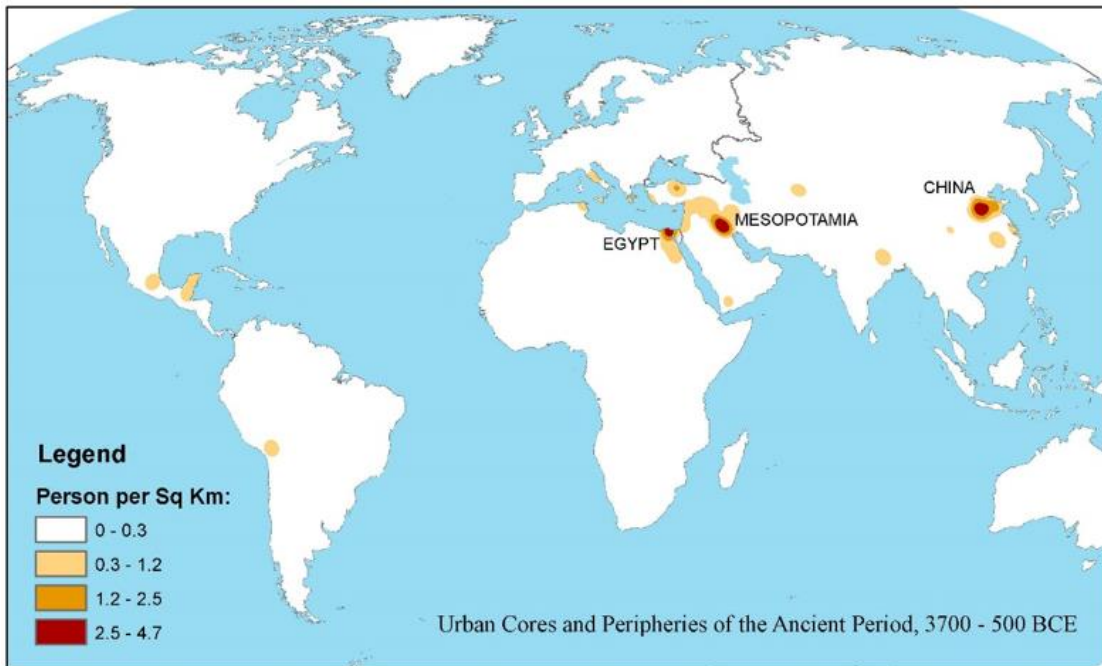


Figure 7. Urban Cores and Peripheries of the Ancient Period, ca. 3700-500 BCE

Three macroregional economies arose during this period: Egyptian, Mesopotamian, and Chinese (or Far Eastern according to World-Systems Theory parlance). Smaller urban core areas are likely represented by the Near Peripheries in other parts of Eurasia and the Americas. But these peripheral regions do not compare to the greater urban population densities of the three agrarian civilizations with macroregions defined as Inner Cores during the Ancient Period.

Interestingly, the ancient Indic region of the Indus river valley did not develop a core of any level during this period. Most surveys of ancient civilizations, however, always include the Indus Valley civilization. The key cities of Mohenjo-Daro and Harappa in the Indus river valley supported about 20,000 residents each, and these estimates are far below the apex cities of the ancient macroregions with median populations of approximately 100,000 (i.e., Pi-Ramesses in Egypt, Babylon in Mesopotamia, and Yinxu and Kaifeng in China).

Scholars do not agree whether the Indus Valley script was a language or merely a complex of signs and symbols, and this distinction is important in how civilizations have been defined as having 'record-keeping'. There is no evidence that the Indus Valley script was a language similar to the ancient languages written with archaic Chinese characters, Sumerian Cuneiform, and Egyptian Hieroglyphics.

Instead, the seals may have represented records of food grains and commodities, and this record-keeping script never evolved into a higher language proper. Throughout human history there have been many languages that never developed a script, but for those languages that did examples of the script have always been found carved on cliffs and other rocks, and also on utensils and various objects.

But the Indus Valley script was not used in this broader manner and is only documented from several thousand surviving seals. And while significant numbers of Indus seals and seal impressions have been found in the Gulf region and far into modern Iraq, no Mesopotamian inscriptions have ever turned up at any Indus site (Farmer et al 2004). The fact that urban population densities did not increase and expand to form a macroregion(s) in the Indus Valley comparable with those in the Middle East and China could indicate the Indus Valley was economically peripheral to Mesopotamia, and also why there was no broader societal need to develop a language proper from the ancient Indus signs and symbols.

The Classical Period, ca. 499 BCE - 500 CE

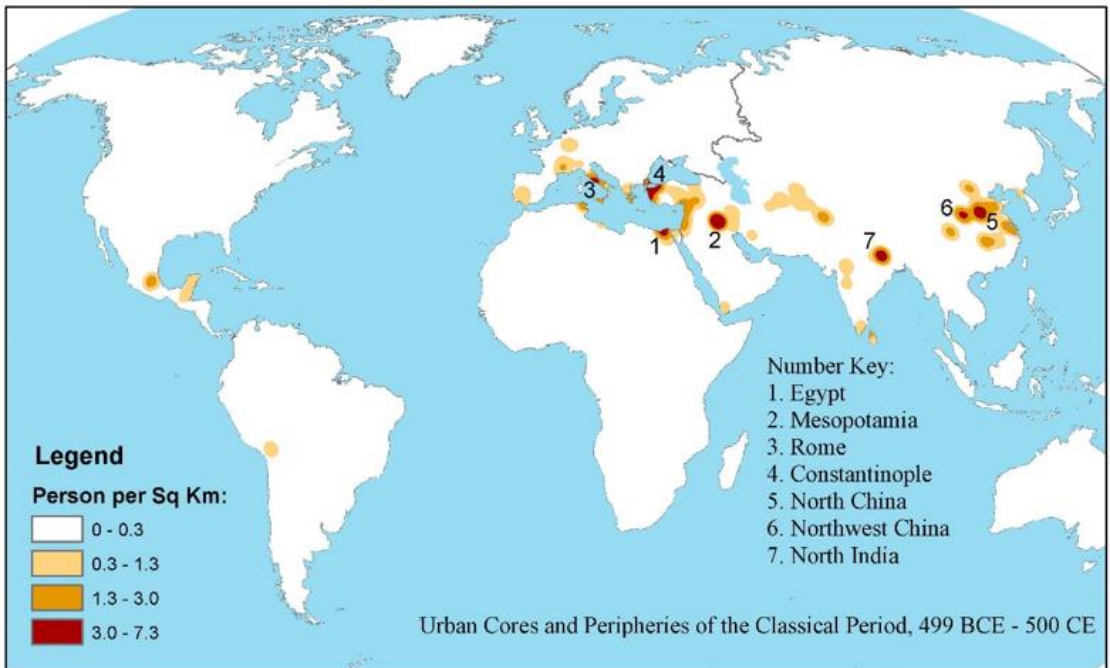


Figure 8: Urban Cores and Peripheries of the Classical Period, ca. 499 BCE – 500 CE

Seven macroregional economies characterize this period with four in the Classical World of the Middle East and Mediterranean, one in North India, and two in China.

The two ancient macroregions in Egypt and Mesopotamia continued to thrive in this period though their apex cities changed. In Egypt, the ancient apex city of Pi-Ramesses was supplanted by the nearby city of Alexandria (pop 400,000). And, in Mesopotamia, Babylon with 200,000 persons was integrated with the nearby cities of Seleucia and Ctesiphon each with 250,000 persons. New macroregions developed centered on Rome (pop 250,000), and on Constantinople (pop 400,000). Clearly defined peripheries separated these four macroregional economies, indicating each was largely self-sufficient in staple bulk-good items.

At the same time, however, the Mediterranean exhibited aspects of a World Economy by this period (if not earlier) made possible by several factors, mainly political integration under the Roman Empire, and economic integration facilitated by maritime trading networks across the inland sea that functioned as one large navigable waterway.

In China, the ancient macroregion centered on the North Central Plain continued into the Classical Period based on the cities of Luoyang (pop 200,000) and Kaifeng (pop 150,000), while a new adjacent macroregion formed in Northwest China centered on the great Han capital of Chang'an (present-day Xi'an).

It is noteworthy these two Chinese macroregions were connected by their Outer Cores, indicating a denser level of urban settlement and marketization throughout the entire region. Here an argument can be made for the first occurrence of a World Economy defined according to Braudel's criteria of historical groupings of macroregional economies providing the material basis for a civilization.

Applying these same criteria to the Classical World is more problematic, because as mentioned above the macroregional economies there were separated by peripheral regions, and an argument needs to be made to combine Greek, Roman, Egyptian, and Persian civilizations under the single rubric of one Classical civilization. Given these complexities, many World-System theorists simply aggregate the entire Middle East and Mediterranean regions into a so-called "Central Civilization" by this period.

Between the Western and Eastern World Economies, Indic civilization exhibited its first macroregional economy during this period centered on the cities of Patna (pop 150,000) and Pataliputra (pop 100,000) along the Ganga of North India. This region witnessed a flourishing of numerous urban centers with populations over 50,000 following the long hiatus of about a millennium since the mature phase of the Indus Valley civilization (ca. 2300-1800 BCE).

Later Buddhist, Jain and puranic sources refer back to sixteen "great countries" (*mahajanapadas*) of ancient India, which were closely linked with the emergence of urban administrative capitals and competed for political preeminence in the mid-late first millennium BCE (Neelis 2011).

Subsequently, this macroregional economy formed the material basis for the Mauryan empire (ca. 400 to 200 BCE) which, like the roughly contemporaneous Roman and Han empires, is credited with supporting economic development based on control over trade, taxation, and monetary policies across South Asia.

At this point in human history, the growth of World Economies and their networks of long-distance exchange benefited, to some extent, the simultaneous growth and spread of universalizing religions that unlike the ancient, place-based ethnic religions, openly welcomed converts. Buddhism spread from its roots in North India during the Classical Period to parts of Central, Southeast, and East Asia along maritime and overland trade routes, as too did early Christian communities spread across the cities and towns of the Roman empire.

Available GIS models of historical economies and censuses of religious adherents, however, are too coarse in their spatial and temporal scales to permit more than interesting conjectures about interrelationships between religious and economic growth within and between different cultures and civilizations at this time.

The Medieval Period, ca. 501 - 1200 CE

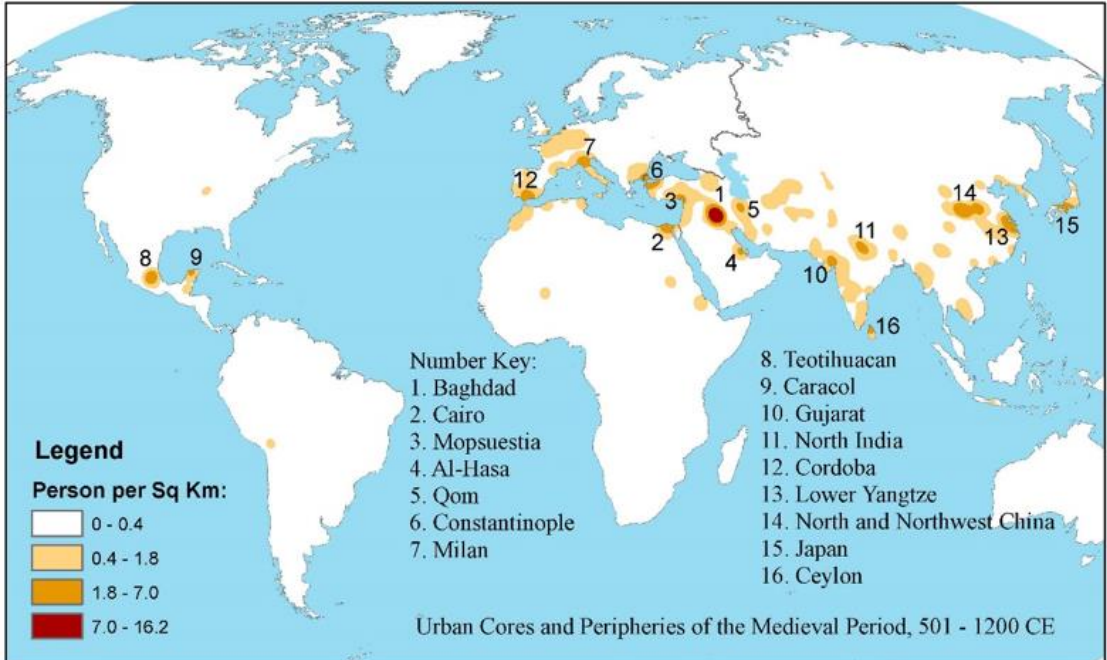


Figure 9: Urban Cores and Peripheries of the Medieval Period, ca. 501-1200 CE

A macroregional economy based on the city of Baghdad appears to have dominated according to the above-mentioned Natural Breaks mapping methodology of this study.

Baghdad was the world's largest city with an estimated urban population of 700,000, and the nearby city of Ctesiphon (pop 500,000) was the second largest.

In contrast, the third largest city was Xi'an in Northwest China (pop 450,000), but here and elsewhere the apex cities of macroregional economies occur in areas perforce labelled as Outer Cores. Considering how the immense size of Baghdad skews global comparisons in this way, the Outer Cores should also be considered macroregional cores in their own right during the Medieval Period.

If this perspective is adopted, the Baghdad macroregion is seen bordered by four surrounding macroregions, that of Egypt now centered on Cairo, Southeastern Turkey centered on the former Greek Byzantine city of Mopsuestia, the Persian Gulf and the oasis city of Al-Hasa located 60 km inland, and Persia centered on Qom and Ray (today absorbed into the greater Tehran metropolitan area).

Interestingly, no other macroregion during this period occupied such a central location relative to surrounding macroregions, which partly explains Baghdad's economic importance and unusually large size.

In the Mediterranean, Constantinople continued to function as the central urban node of a macroregional economy. And the center of the Italian macroregion shifted north from Rome to Milan where it would function for another six hundred years during the Early Modern and Modern periods.

A clear development of macroregional economies is also evident in the Americas with core areas of Aztec civilization in Central Mexico (centered on the city of Teotihuacan), and Mayan civilization on the Yucatan (Caracol) identified. The Mesoamerican civilizations were relegated to peripheral status during the two previous periods by the relatively larger Eurasian civilizations, but it should be noted that during the Classical period one macroregion is already discernable in Central Mexico based on an Outer Core level of urban population density.

During this period the world's third great universalizing religion of Islam developed within the now larger system of Middle Eastern macroregional economies, and also established itself in two distant macroregions; in Gujarat of western India centered on Patan and Cambay, and in Andalusia of southern Spain centered on Cordoba.

Both of these distant macroregions were separated from the Middle East by vast tracts of sparsely populated deserts but connected by both overland and maritime trade routes of the Mediterranean and Indian Ocean. One result of Islam's early diffusion to Gujarat was its subsequent spread and growth among communities in Southeast Asia.

The Gujarati Muslim traders occupied a relative central position between the macroregions of Western Civilization (or “Central Civilization”) and East Asia which by this period included both the growing Chinese world economy and Japan. In China, the Lower Yangtze macroregion arose and functioned in addition to the two earlier North and Northwest macroregional economies.

Meanwhile in Japan a central macroregional economy arose centered on the ancient cities of Nara and Kyoto. Partly as a result of increased world trade between East and West, a distinctive South Asian world economy developed during this period.

In addition to macroregions centered on Gujarat, and along the Ganga in North India, a third macroregion arose on Ceylon.

The Early Modern Period, ca. 1201 – 1500 CE

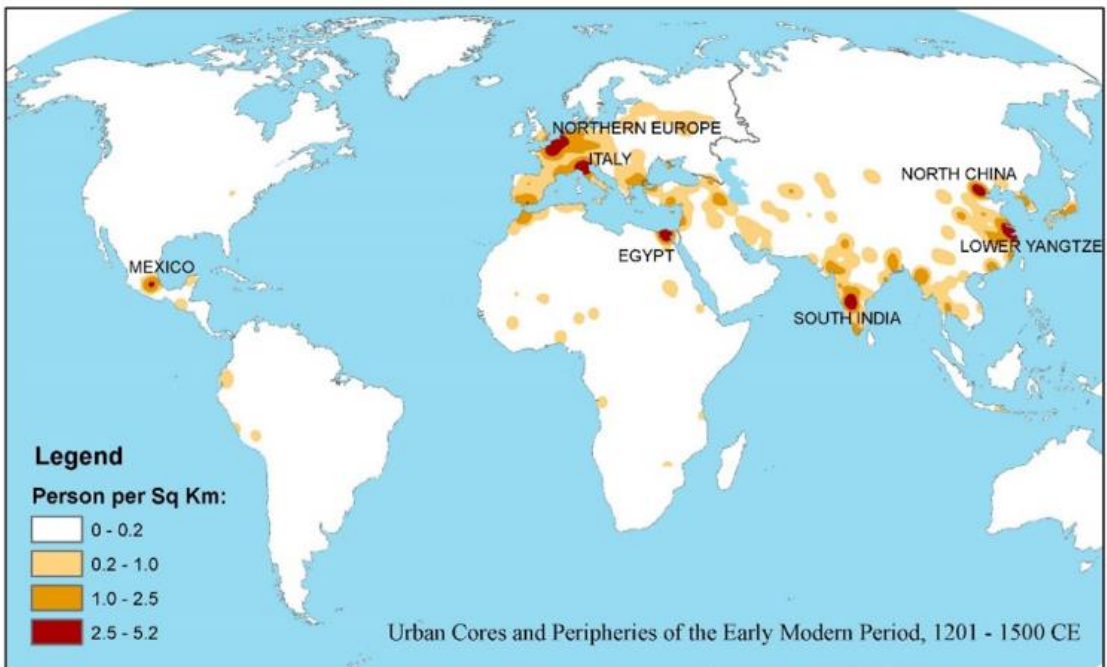


Figure 10: Urban Cores and Peripheries of the Early Modern Period, ca. 1201-1500 CE

There was a marked shift of macroregional economies to northern Europe for the first time in recorded history during this period based on a number of cities from Paris and Rouen in northern France, to Brugge and Ghent in the Low Countries. And the core region of the Italian macroregion expanded in size with the increase in urban populations of many key cities in addition to Milan, namely Bologna, Florence, Genova, and Venice.

In North China, a macroregion developed around the Mongol's new capital in Beijing, while the Lower Yangtze continued to function. However, the former macroregional economies of North and Northwest China centered on Kaifeng and Xi'an declined to peripheral status partly as a result of the Mongols' defeat of the Song.

In fact, the expansion of the Mongol Empire during the thirteenth century across Central Asia to Persia does not coincide with any macroregional economies besides these two in North China and the Lower Yangtze administered as part of the Yuan Dynasty or the "Empire of the Great Khan" (i.e., Kublai Khan). The other Mongol khanates included the Chaghadai, Golden Horde, and Ilkhanate. All four polities are often described as forming the largest land empire in world history.

In comparison, most of the economic cores of the Medieval Period in the Middle East, Persia, and North India declined to peripheries with only one core in Egypt and one in South India functioning during this period of Mongol supremacy.

The Mercantilist Period, ca. 1501 - 1800 CE

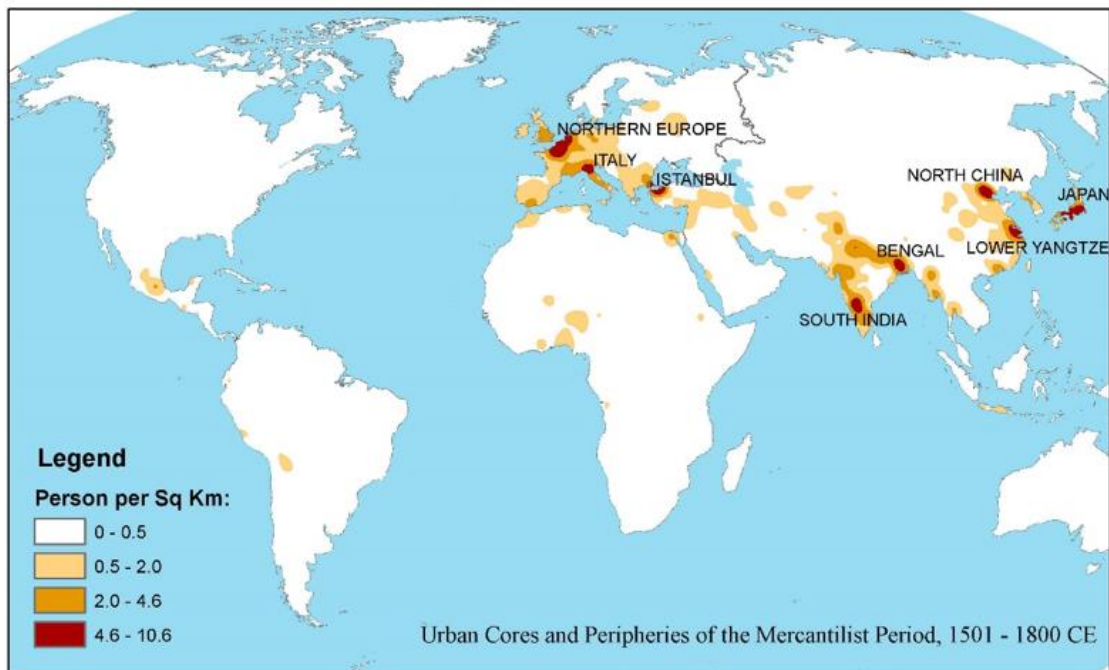


Figure 11: Urban Cores and Peripheries of the Mercantilist Period, ca. 1501-1800 CE

The initial creation of a Global Capitalist Economy resulted from the Columbian Exchange with its new forms of trade and finance supporting and regulating imperial, and colonial, expansions of the European World Economy.

In Wallerstein's first volume of his seminal work, *The Modern World System*, this sixteenth century European World Economy is defined as "constructed out of the linkage of two formerly more separate systems"; the Christian Mediterranean system centered on the Northern Italian cities, and the Flanders-Hanseatic trade network of north and northwest Europe.

Furthermore, connected to this new complex was East Elbia, Poland, and some other areas of Eastern Europe, and various Atlantic islands and parts of the New World (1976:68).

Note what Wallerstein considers "more separate systems" are in fact the two separate macroregional economies already identifiable during the Early Modern Period with one core in northern Italy, and another core in Northern Europe, while Eastern Europe functioned as a peripheral hinterland to Northern Europe's core. To the east, the only other macroregion of the Western World during this period was based on Constantinople/Istanbul. This core functioned as the main economic base of the Ottoman Empire after Constantinople was captured from the Byzantines in 1453.

In Asia, the three macroregional economies of the previous Early Modern Period continued to thrive in South India, North China, and the Lower Yangtze region, but two new macroregional economies emerged.

One macroregion was based in Bengal, and one in Central Japan. Specifically, Japan's medieval urban core expanded north from the area of Kyoto and Nara to Tokyo which had become the largest Japanese city by this period. Interestingly, both of these new cores developed along seacoasts where port cities likely connected these regions with the increased trade and commerce emanating from Europe.

According to Wallerstein, the creation of a single World-Economy can be precisely measured by the spread of increased prices at the beginning of the fifteenth century, and in the long run the closing of the gap in regional price variations by the eighteenth century. One major explanation of these historical price increases relates to the global spread of New World gold and silver, and the general rise of capitalist activity that accounts for the use made of this bullion compared to traditional uses, such as casting religious idols and gilding temple roofs.

World-Systems Theory assumes increased modes of commerce, and new capitalistic forms of trade and finance, led to greater control by the historical European World Economy over the rest of the world culminating in the creation of a single World-Economy. Wallerstein, however, offers no specifics to map and measure these assumed changes across entire macroregional economies in the way that Regional Systems Theory does with deductive cartographic visualizations related to theorized changes in rural to urban exchange systems.

For example, were European political directives and economic ventures alone sufficient to redirect enough bulk goods from rural areas in the traditional peasant economies of Asia to alter demographic processes in core areas, or did historical systems continue but with new capitalistic mechanisms?

This question best frames the purpose of this study on integrating World and Regional Systems Theories in ways to permit new and accurate mappings of how historical World Economies of different civilizations and cultures changed in relation to new capitalistic methods of trade and marketing.

One specific example concerns historical gender imbalances between rural and urban areas in different cultures. Skinner (1988:27) theorized that in traditional agrarian societies with consistent male-centered kinship systems (such as China or India), it was primarily men who were sufficiently mobile to take advantage of economic opportunities away from home.

By contrast, in agrarian societies with cognatic kinship systems (such as France or Japan), there was institutional scope for economic opportunities away from home to develop for women as well as men and female migration to take on significant proportions. According to Regional Systems Theory, there likely would have been more men drawn to the new Bengal macroregional core of South Asia, but more women drawn to Japan's new core around Tokyo where the demand for female labor was high.

These social processes are related to economic growth, but not determined by it, thus integrating World and Regional Systems Theories will allow for a fuller understanding of how cultural norms and values of different societies interrelated with economic growth and change over time.

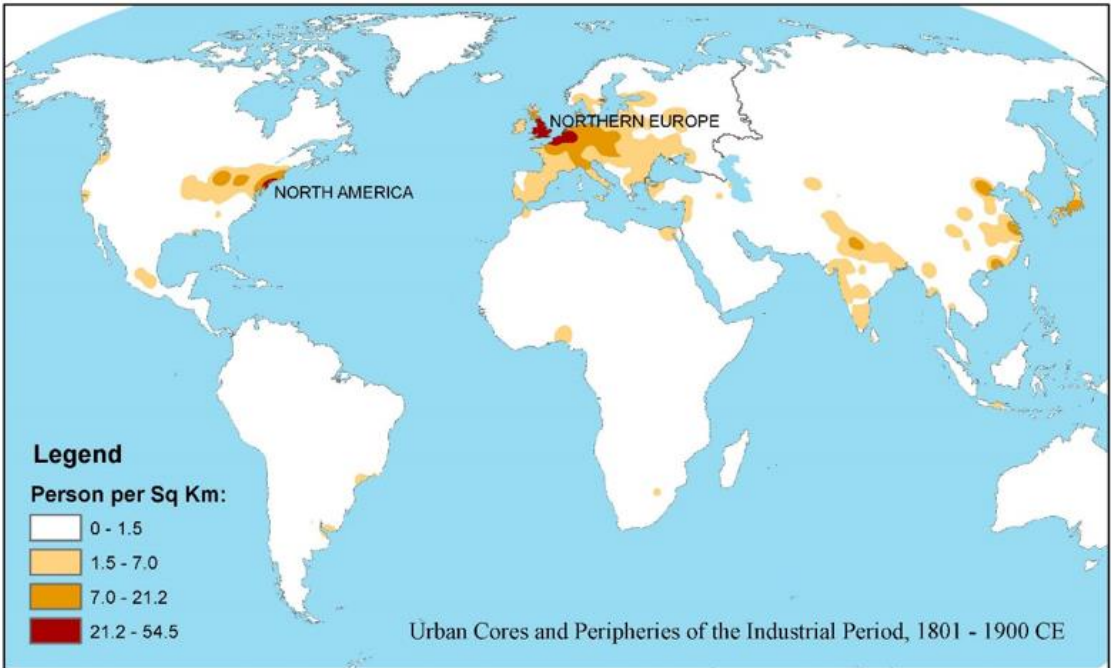
The Industrial Period, ca. 1801 - 1900 CE

Figure 12: Urban Cores and Peripheries of the Industrial Period, ca. 1801-1900 CE

Industrial capitalism led to larger rural to urban migrations in the West, as evidenced by these new macroregional patterns. Over the course of this century, the entire world became peripheral to two economic macroregions, one based in Northern Europe since the Early Modern Period, and a new North American core.

The striking spatial contrast gives new meaning to the term “The West and the Rest.” The apex cities of the European Inner Core were London and Ruhr in Germany, while New York and Philadelphia were the largest cities in the American Inner Core. The growth in urban populations made possible by industrialization are well documented, such as in the rise of Urban Societies when England became the world’s first such country where more than half the population lived in urban settlements by the second half of the nineteenth century, though America did not follow until about 1920.

Comparing areas mapped as Outer Cores, it can be seen that much of Eastern Europe was included by this period. In the Mediterranean, however, only Northern Italy was part of the overall European core, while the rest of Italy and Spain declined to peripheral status. Otherwise, only a small Outer Core survived around Istanbul, reminiscent of its former economic strength under the Ottomans. In Asia, three Outer Cores existed in China, one in Central Japan, and one in North India. In America, the new industrial economy created two Outer Cores, one centered on Detroit, and another on Chicago.

Conclusion

The global historical mapping approach of this study based on a GIS database of estimated urban populations facilitates comparisons between core and peripheral economic regions of different societies and civilizations.

A number of new comparative findings about historical changes in areas of economic growth counter many long-term assumptions. For example, urban settlement in the Indus Valley during the Ancient Period did not produce core economic regions on par with civilizations in Egypt, Mesopotamia, and China. It is possible the Indus Valley was peripheral economically to the Middle East. Conventional humanistic models of civilizations cannot account for these differences and need to be evaluated in relation to economic factors too.

China offers another intriguing example, one that may be defined as the world's first occurrence of a World Economy during the Classical Period based on historical groupings of macroregional economies within the same civilization. In the West, by contrast, macroregional economies were separated by peripheral regions, as seen with those of Greece, Rome, Egypt, and Persia. Finally, during the Industrial Period, new developments in trade and production allowed Northern Europe and Northeastern America to attain sole urban core status at the expense of the entire world.

Integrating World and Regional Systems Theories with GIS methodologies permits the Global Capitalist Economy, historically based in the Western centers of trade and commerce, to be mapped as the sum of its parts. Specifically, social and demographic processes of different agrarian societies are compared to changing urban-based systems of trade and marketing over time. As a result, complex cultural and socioeconomic processes are not reduced to abstract notions of labor and capital removed from their geographies.

According to Regional Systems Theory, the demographic processes involved (fertility, mortality, and migration) covaried in the same consistent manner across rural to urban hierarchies of internally differentiated nodal territorial marketing systems, but demographic processes involving nuptiality and gender differed in their spatial dynamics from one agrarian society to another in accordance with differences in kinship and family systems (Skinner 1988). Industrial capitalism ultimately changed the traditional marketing systems of Eurasian peasant societies, but uneven development, and debates over cultural heritage and identity, indicate social and economic modernization are ongoing and contested spatial processes that need to be mapped at local to regional scales to permit global comparisons and understandings.

Future research would benefit from improving upon this GIS database with historical urban populations for more towns and cities, and by providing estimates for each century. One weakness of this current study results from missing urban population estimates for some cities during entire historical periods leading to local inaccuracies in the mapping of core-periphery economic regions. It would be worthwhile to conduct this survey again with interpolated values of all 1741 cities for each century, and to map patterns of growth and decline accordingly rather than by these broad historical cultural periods.

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