Population Movement, Labor, and Wages in the Age of Universal Empires in the Near East

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Introduction

From the late eighth century BCE through to the fall of the Ottoman Empire in 1922, the Near/Middle East and surrounding regions in Eurasia were almost continuously dominated by large states and empires that frequently surpassed more than 500,000 sq. km in size.[1] While periods of political fragmentation occurred, where at times smaller regional states experienced greater autonomy from larger empires, the general trend witnessed was one of larger states and empires enabling some cities to become much larger and accumulate greater flows of trade and wealth.[2] One key factor that facilitated the growth of population, trade, and wealth for some larger cities was the movement, or migration, of individuals and families to regions with large or primate cities, while other regions shifted to less densely occupied areas in the countryside.

This movement had a great impact on how and where populations settled, and it affected the long-term social and political organization of Near Eastern societies for more than 2,000 years. Some evident social changes occurring in this timespan include: increase in common philosophical and religious ideas;[3] increase in common expressions in material culture and arts over a wider area in Eurasia;[4] and the sharing of languages, such as Aramaic and Greek, by multi-ethnic populations over long distances.[5] Common cultural traits, shared by an increasing number of people, began to emerge. We term this phenomenon "universalism," defined as the process whereby an

1 E.g., Morris and Scheidel 2009; Altaweel and Squitieri 2018.
2 Binliff 2013; Woolf 1997.
3 Gross 1998.
4 Boardmann 2015; Canepa 2009.
5 Gzella 2015; Horrocks 1997.

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increasing sociocultural commonality and sharing emerges across different populations and socioeconomic classes.[6] The emergence of such universal cultural traits reflects not only greater communication and cross-regional connectivity, including trade, but also enhanced population mobility and integration, relative to earlier periods, that brought together people from different cultural backgrounds. This phenomenon was persistent and developed into a long-term pattern for different regions in the wider Near East under large empires, and it became especially evident within large and cosmopolitan cities. We term the period where such universal trends emerged, from around 800 BCE, the "Age of Empire" (AoE).

One economic result often not considered in Western Asia, including the wider Near East, during the AoE, which is partially contemporary to what has been called the "Axial Age,"[7] is how the presence of large political entities would have affected labor migration in ways that were not possible in earlier periods. Not only would the enhanced flow of labor in this wider period (which may have also occurred in the form of forced migration, such as through deportations) have allowed more individuals to take part in local economic activity, but the increased labor pool may also have helped intensify or extensify production. This growth in labor could have also helped fuel trade with increased production of goods. Egypt and Southern Mesopotamia are two regions that produced some evidence, from about the sixth century BCE and into later periods, intensive/extensive agricultural production of wheat, barley, and date palms, although other crops continued to be grown.[8] Increased mobility in the form of economic trade would allow food resources to be more intensely traded, as, for example, within a large region such as Babylonia. This would have diminished the need to grow diverse agricultural products within a smaller region, enabling some regions to specialize in agricultural production that could then be exchanged.[9] Agricultural activities, such as date palm or grain production, are very intensive and/or extensive at large scales. We might expect wages to increase over time as demand for given products increased. However, migration could counteract this trend by making a surplus of labor available, particularly in unskilled areas, thanks to the relative political stability and ease of movement offered by larger states and empires.[10] Based on these observations and considerations, where intensive/extensive agriculture and increased migration are evident, the goal of this work is to determine how unskilled labor wages, critical in agricultural production and exchange, may have been affected by labor mobility in the Near East and Egypt during the AoE.

6 Altaweel and Squitieri 2018, 8.
7 Jasper 2010.
8 Greene 1986; Jursa 2006; van der Spek and Leeuwen 2014.
9 Jursa 2007; 2010.
10 Whittaker 2008.

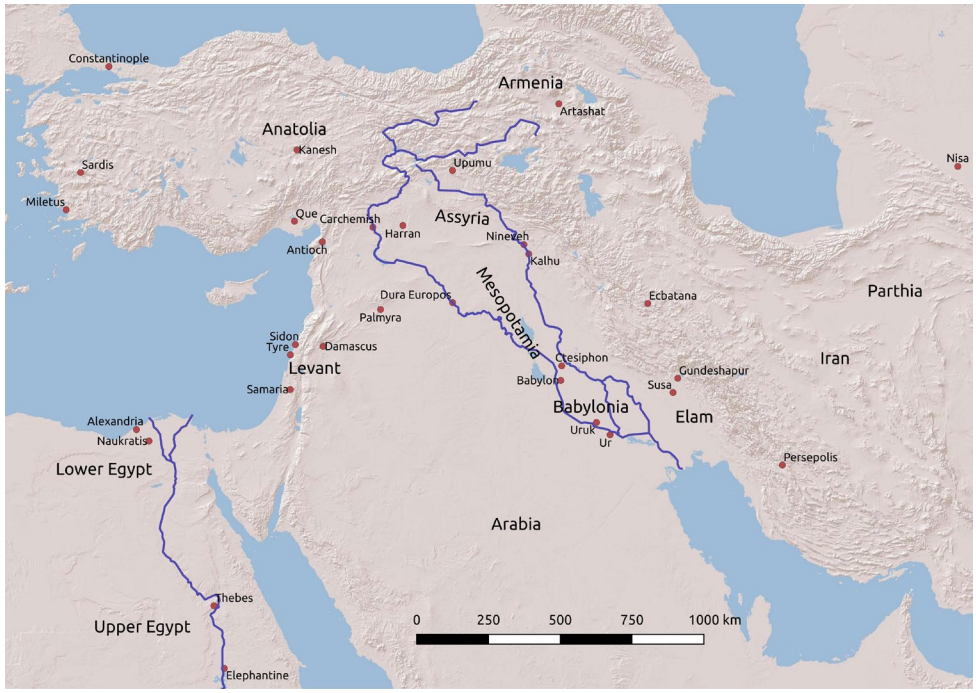

Fig. 1 Region assessed and key sub-regions and cities discussed in this paper.

This work focuses on presenting empirical evidence for wage development in the ancient Near East and surrounding areas during a period of large states and empires. Data from the assessed region offer a unique possibility of combining information on migration and wages, providing insight into this relationship that is not easily achievable elsewhere in the ancient world. The work combines previous model output on mobility with new data that can enable a reassessment of wage development to be made. We present below a new analysis and perspective that integrates existing archaeological data with documentary sources to investigate the effects of labor migration. Documentary data include labor wages; archaeological data include settlement patterns and regional evidence for mobility. The periods analyzed span from the pre-AoE (ca. 3000–800 BCE) to the AoE (ca. 800 BCE – 651 CE). The area and places analyzed are included within Egypt to the west, Iran to the east, the southern Caucasus to the north, and Arabia to the south (Fig. 1). We begin by giving background information on general political trends and mobility in the wider Near East and Egypt. We then discuss the effects of population movement and present methods for analysis and results on population movement, demonstrating migration potential using settlement data. Supporting data and evidence for migration using material culture and historical

data are also given to provide a general historical trend. We then assess wages of unskilled labor, mostly in Mesopotamia and Egypt. The combined data, including those presented and referenced from elsewhere, are discussed in relation to labor migration and its wider economic effects during the AoE.

Historical Background: States and Transport

Before providing evidence on labor mobility and wage changes, some brief historical background describing the major political changes prior to the start of the AoE and after is needed. From the early third millennium BCE to the end of the Late Bronze Age (ca. 1200 BCE), the historical data reveal a prominent trend towards states occasionally growing large (i.e., >500,000 sq. km), but then reverting back to relatively small polities. Empires developed, but they often lasted only a few generations and were generally not replaced by larger states after their collapse, with usually a plethora of small political entities replacing them. Overall, most of the states that did arise prior to the AoE were small, while the opposite was true during the AoE.[11] Fig. 2 shows estimated areas for some well-known states prior to the AoE and during the AoE (Appendix A:1). Although this is not a comprehensive list of all states, the list does show some of the better-known states for these periods, demonstrating the general trend towards larger states during the AoE. Furthermore, larger states tended to succeed one another, while this was not the case during the "pre-AoE." An example of this includes the Ur III state (ca. 2100–200 BCE), which was succeeded by small city-states in southern Mesopotamia.

Contemporary with political changes in the AoE, from the eighth century BCE and later, we see increased movement capability. This is reflected both by physical improvements in equipment and technology—such as the use of camels as pack animals[12] and advances in sailing and navigation,[13] which increased the range of mobility and the areas of accessibility—and the availability of more direct and faster routes, such as royal highways and long-distance roads.[14] From the eighth century BCE, it also became politically feasible to move more rapidly due to the reduced number of state borders. Evidence for the speed of transport is present from historical documents. In the Old Assyrian period (ca. 2000–1600 BCE), trade caravans going from northern Mesopotamia (Assyria), that is, from modern northern Iraq, could reach Central

11 Stiebing 2018; Liverani 2014; Potts 2010.
12 Potts 2004.
13 Heing 2018, 23; McLaughlin 2010.
14 Altaweel and Hauser 2004; Colburn 2013.

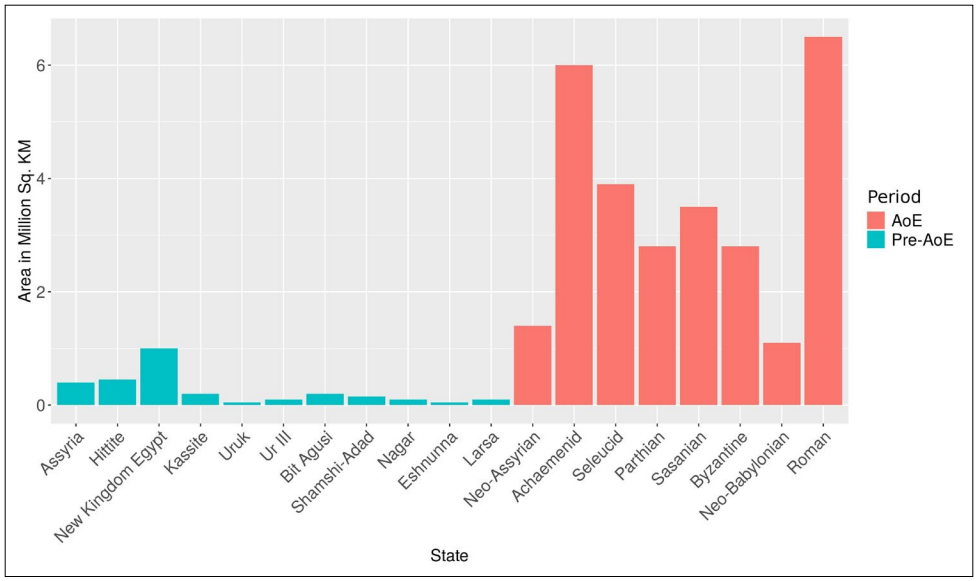

Fig. 2 Pre-AoE and AoE states' areas expressed in millions of kilometers squared.

Anatolia (Kanesh) in about forty-two days, covering approximately 1,100 km in that time, or an average of around 26 km/day.[15] This contrasts with later Neo-Assyrian (ca. 900–612 BCE) and Achaemenid (ca. 550–330 BCE) periods, when speeds of nearly 140 km/day within northern Mesopotamia and 225 km/day across Iran and Anatolia were achieved, respectively—including, in many cases, travel along royal roads.[16] To be fair, travel in the Old Assyrian period took place via donkey, primarily for trade, while documents referring to travel from the Neo-Assyrian and Achaemenid periods were regarding communication using horses, which was intended to be rapid. However, differences in the duration of travel also have to do with political change. In the case of the Old Assyrian period, travel was less direct, often avoiding hostile states or fees that might be incurred in moving trade goods. On the other hand, later travel was more direct, used faster means of travel, and had fewer political barriers to affect movement. In fact, stations were purposely built by the Assyrians and Achaemenids to facilitate faster transport. Roads for rapid transit are evident from satellite data, which indicate direct routes, that is, routes that minimize distance between cities, built during the Neo-Assyrian period as well as later.[17] Furthermore, for general travelers, going

15 Barjamovic 2011, 15.
16 Colburn 2013; Radner 2014.
17 Altaweel 2008; Altaweel and Hauser 2004.

between Susa and Sardis during the Achaemenid period—that is, from Southwest Iran and Western Anatolia—travel speeds were close to 60 km/day, which is still far higher than speeds achieved during the Old Assyrian period. In the second century CE, Chinese sources describing travel between Hecatompylos in Northern Iran to Chaldea in Southern Mesopotamia also report similar travel speeds of ca. 60 km/day.[18] Overall, these data on movement suggest that it became easier for more travelers to move and transport trade goods farther distances at faster speeds. While we can infer trade and communication became more intense in the AoE, data do not indicate the volume or scale of population movement, but one can determine that barriers to long-distance travel were less in the AoE and mobility became easier due to technical and political developments after ca. 800 BCE.

Effect of Movement: Settlement Structure and Empires

Migration and Its Effects

In the wider economic literature, we see that population movement can have an impact on wages and other characteristics of economic life. Migration has been shown to have distinguishable effects on productivity[19] and wages.[20] In urban contexts, migration can affect demand for resources, such as housing,[21] while also potentially introducing skills or resources that might be in greater need in host areas.[22] One historical trend observable in countries such as the mid-twentieth-century United States or nineteenth-century England has been that, as migration increased or became easier due to improvements in transportation, some cities benefited and populations increased rapidly, with wages converging across different neighboring regions. Different and faraway cities developed similar wage levels due to improvements in both communication and workers' ability to move easily across greater distances to pursue opportunities.[23]

18 Hirth 1885, 36–40.
19 E.g., Clemens and Pritchett 2019; Klein and Ventura 2009.
20 E.g., Arpaia et al. 2016.
21 Brueckner and Lall 2015.
22 Boubtane et al. 2016; Boyer 1997.
23 Boustan 2009.

Migration data for the ancient past is difficult to quantify, but a variety of data has been utilized. This includes textual sources,[24] portable material cultural remains,[25] biochemical indicators,[26] and DNA.[27] Although these data are useful, other measures are possible, including the use of settlement structures obtained through archaeological survey data to quantify migration and population movement. Specifically, rapid growth and decline in settlement size can be indicative of immigration and emigration caused by factors such as political change or the availability of new opportunities.[28] Settlement surveys that provide estimates on relative site sizes in survey regions are potentially important for determining likely migration flows across different periods.

Measuring Population Movement

For early preindustrial societies, low rates of natural population growth were likely the result of high mortality rates, suggesting that ancient cities often did not grow rapidly by birth rate alone.[29] In many ancient cases, similar to today, rapid urban growth was often possible through migration, often fostered by trade and economic opportunities, political policies, or other cultural factors incentivizing migration. Additionally, involuntary migration is evident in historical sources as early as the late fourth millennium BCE. This often occurred when captives were taken during conflicts.[30] However, by the first millennium BCE, in particular during the rise of the Neo-Assyrian Empire (ca. 900–600 BCE), deportation became a commonly used tool for political punishment but also to shift populations for economic purposes, which ranged from utilizing skilled to unskilled labor.[31] Deportees were sometimes even provisioned with supplies to work the land. One likely result of this was a greater population concentration, including an increased labor supply, in regions which received an influx of migrants. Overall, regardless of the underlying reason, migration has the effect of (relatively) rapidly increasing populations in some cities, while it may also rapidly diminish populations in different regions.[32]

Huff articulated how economic, geographic, and ecological factors interacted to contribute to urban growth when he investigated the effects of migration on trade and

24 E.g., Beckman 2013.
25 Chapman and Hamerow 1997; Batiuk 2013.
26 Killgrove and Montgomery 2016.
27 Shriner et al. 2016.
28 Kemper 2008; Bonifazi and Heins 2003; Champion 2001.
29 McNeil 2000.
30 McIntosh 2005, 167.
31 Pirngruber 2017, 204; Oded 1979.
32 Persson 2010.

urban growth.[33] One method that can be used for understanding spatial structures of past settlements is spatial interaction entropy modeling (SIEM), in which settlement size or population is studied in urban regions composed of interacting settlements. Settlement structures, which provide information on settlement sizes within a defined region of sites, provide insight into: why populations concentrate in a particular location; the factors shaping settlement sizes based on locations available to migrants within a given landscape; and the social and economic opportunities settlements offer to an incoming population. This method has been used in archaeology to study settlement patterns across different regions,[34] demonstrating how settlement structures evolved during different periods and the potential reasons for these changes, such as their relationship to transformations in mobility and economic opportunities.

In the use of SIEM, relationships between settlement size, using estimated area and defined geographies that account for the spatial layout of settlements in different periods, can be used to determine how mobility and migration could affect a settlement's growth or decline. Results from models include returns on attractiveness for sites (called α) and factors that relate to the cost of moving (called β), which include impediments to moving, such as topographical, political, social, or monetary costs. We can think of α and β as pull and push factors that move people from or to given settlements based on incentives, costs, and ability to move. By running multiple simulations with a variety of α and β inputs, it becomes possible to match the best simulated results to the empirical data. In other words, SIEM explains α's and β's effects on given settlement structures observed from archaeological survey data. In the ancient Near East, settlement structures have been studied by archaeological surveys that record approximate settlement sizes and spatial distribution of sites.[35] Several such surveys in the Near East have recently been investigated by Altaweel and Squitieri,[36] where we use these collected α and β data to better understand how mobility (β) may have shaped observed settlement patterns. The method deployed in creating those results is discussed in detail by Davies et al.[37] In summary, β determined from simulated settlements, which is compared and fitted to survey data, can be used to provide an indication of the migration and mobility that contributed to the observed settlement structures. That is to say, the size and distribution of sites in given areas can match modelled output β values, helping to demonstrate how population movement could have contributed to these settlements.

33 Huff 1963.
34 E.g., Bevan and Wilson 2013; Davies et al. 2014; Altaweel 2015.
35 For example, see Adams 1981; Wilkinson and Tucker 1995.
36 Altaweel and Squitieri 2018.
37 Davies et al. 2014.

Survey Data, Settlement Size, and Mobility

Data collected by Altaweel and Squitieri[38] have been primarily used to assess Bronze Age, or pre-AoE (before 800 BCE) β values, and β values for settlement systems during the AoE. These data represent regions that include northern Mesopotamia, southern Mesopotamia, southwestern Iran (Khuzestan, incorporating the area of ancient Elam), and Central Anatolia (around Kanesh). Other regions, such as around Antioch, have been analyzed, but they did not have data spanning the pre-AoE and AoE periods, and the surveys covered smaller geographical areas. Fig. 3 shows the β values from SIEM simulations, where the overall trend indicates declining β for different survey regions from the pre-AoE to the AoE. Here, declining β indicates settlement structures that are possible because of increased mobility. The results suggest that, in order to create the settlement patterns evident in the survey regions from the available data, β becomes generally low, where lower values indicate increasing and easier levels of mobility in the AoE. Periods prior to 800 BCE had β values greater than 0.5, with 0.651 being the highest value, while lower β values, such as those near 0.0 or lower, are generally found from the AoE (that is, beginning around 800 BCE). This trend is evident both within and between different regions. The figure uses approximate midpoint dates for different settlement surveys, and, therefore, this cannot be seen as temporally exact, but the trend is clear. Some regions, such as northern Mesopotamia, demonstrate a long-term, increasing ruralization with smaller settlements, while other regions, such as southern Mesopotamia, developed large primate cities. Regardless of whether a region grew more rural or became dominated by one very large site, declining β over time and into the AoE suggests that settlements in regions increasingly became easier to travel to.

Using data on settlement size collected in Altaweel and Squitieri 2018 and listed in Appendix A:3, it is also possible to measure disparities in urban size to suggest that populations began to concentrate in certain regions. Analysis of the largest and smallest sites within survey areas, measured in hectares and using Gini coefficients[39] to evaluate disparities in settlement sizes, reveals that Gini values increased as settlements became far larger in specific places in the AoE, including southern Mesopotamia and Khuzestan (Fig. 4). This indicates some sites grew far larger than their neighboring regions and cities, with cities such as Babylon and Antioch dominating more greatly in relative population distribution in the AoE than pre-AoE cities. In other words, there was more disproportionate population concentration in larger cities in the AoE periods. Both patterns, that is, lower β and higher Gini coefficients for settlement

38 Altaweel and Squitieri 2018; Appendix A:2.

39 Dixon et al. 1987. Gini coefficients indicate the degree of inequality or disparity in given distribution data. Often, this has been used to measure differences in wages or wealth.

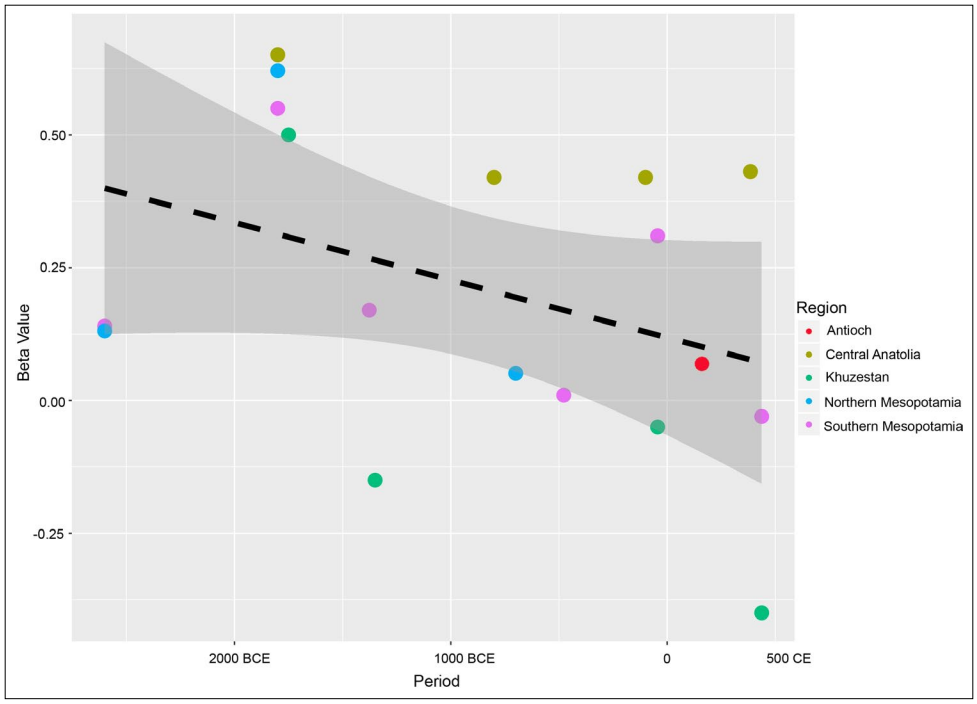

Fig. 3 Determined β values from SIEM models applied to different surveys in the Near East. The β values act as a proxy for mobility of populations that would enable observed settlement structures as determined in surveys. Dates given are approximate midpoint dates for different survey periods.

size, suggest increased mobility across the Near East.[40] For cities with disproportionately large populations, migration would have been the most likely factor enabling their urban growth. For Egypt, we are missing urban and settlement data that reflect mobility; however, we can infer that a pattern similar to that which occurred in the Near East also took place, based on the disproportionate concentration of population in Alexandria, at least by the Ptolemaic Period (305–30 BCE).[41] Overall, it is likely that a large disparity between the largest site (in this case, Alexandria) and other sites suggests that a similar pattern of relatively easier movement resulted in the urban hierarchies that were present in Egypt.

40 Altaweel and Squitieri 2018; Palmisano and Altaweel 2015; Altaweel 2015; Davies et al. 2014.
41 Chauveau 2000.

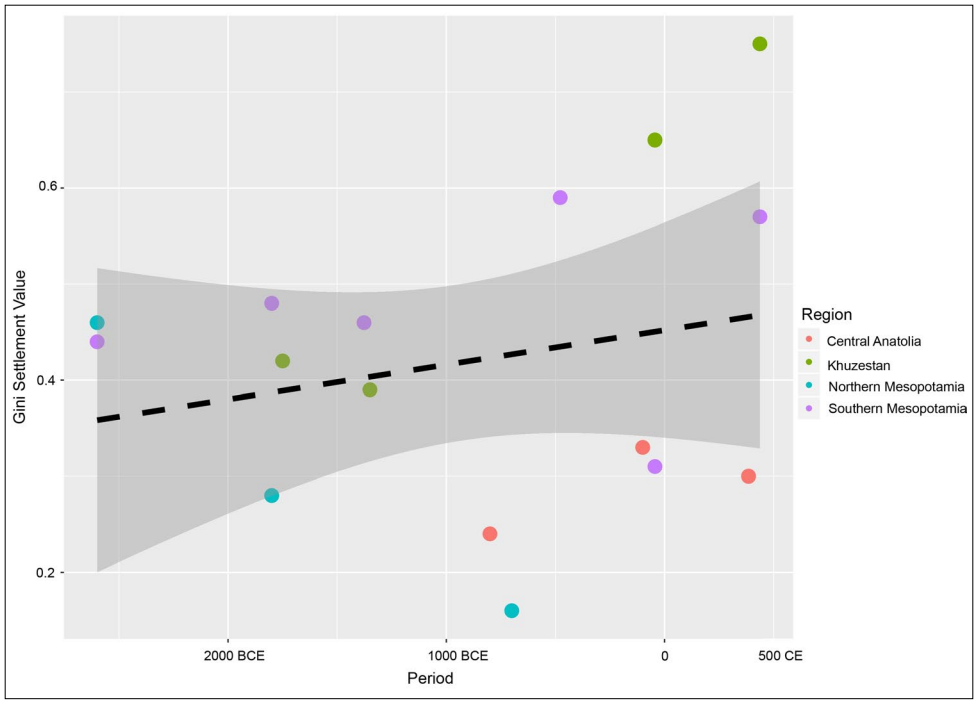

Fig. 4 Gini coefficient values graphed over time for settlement survey regions, which measured disparity between site sizes. Overall, particularly in regions where sites became very large, the trend indicates increased disparity between smaller and larger sites in the AoE. Sites such as Babylon and Ctesiphon became relatively more dominant in size in comparison to their neighboring sites.

Other Supporting Data on Migration

To support the results observed above, we present a brief survey, using archaeological and historical data, that demonstrates that new populations did move to different regions. Our intention is to provide empirical evidence supporting greater population mobility, as suggested above, for the AoE investigated. In Egypt, Hellenistic and Roman Alexandria has been seen as a wide mixture of Greek and non-Greek populations that had migrated to the city, where populations concentrated from around the Mediterranean and beyond.[42] Syncretized Greco-Egyptian art and religion symbolized the multi-ethnic populations of the region and city. Migration increased not only after Hellenistic influences (that is, from 305 BCE) in the wider Mediterranean but also in

42 Haas 1997; Fraser 1972.

earlier periods within the AoE. Naukratis and Elephantine[43] in the Achaemenid period are examples of urban populations with different cultural backgrounds intermixing prior to Alexander's conquest. In Elephantine,[44] Jews and Arameans were likely placed there during the Achaemenid period, potentially accelerating a process of multi-ethnic populations within urban centers.

To the east of Egypt, during the Neo-Babylonian (626–539 BCE) period, Babylon in southern Mesopotamia became a primate city in the region, growing to perhaps as much as 800–1000 hectares. The city had also become ethnically diverse, with Elamite, Arab, West Semitic, Egyptian, Jewish, and other populations present.[45] In the Neo-Assyrian period, Nineveh witnessed an influx of foreign populations; in large part, these were populations that had been physically imported to work on major projects during the expansion of the city.[46] In the Achaemenid period, evidence for an increased level of migration is suggested at Persepolis through the Persepolis Fortification Archive, with workers brought to work on the new capital.[47] Ethnic groups mentioned included Elamite, Capadoccian, Indian, Egyptian, and Semitic populations, with at least six different languages used in the site's historical data. Similar patterns are evident in later periods, with cities such as Dura Europos and Palmyra in Syria providing evidence for at least seven different spoken languages and having places of worship for many different cultures and gods,[48] reflecting populations from regions spanning from Greece in the west to Iran in the east. Overall, we can see that urban regions began to receive an influx of distant, foreign populations, including in both some of the largest cities, for example, Babylon, and smaller towns, such as Dura Europos. This pattern persisted throughout much of the AoE.

A pattern of increasing hybridization of material culture characterizes most periods within the AoE, across an area spreading from the eastern Mediterranean to Central Asia. This pattern can also be used as a proxy for increased population movement and the multi-ethnic characteristics of populations. This phenomenon was the consequence of easier movement of artisans and the dissemination of their design ideas over a greater area than had previously been possible,[49] along with the emergence of a cosmopolitan, culturally-mixed clientele demanding cross-cultural styles they could identify with.[50] Similarly, the emergence of universal languages used cross-culturally

43 Dandamaev 1989, 114.
44 Porten 1996.
45 Moukarzel 2014; Zadok 1979; 1990.
46 Zaccagnini 1983.
47 Dandamaev et al. 2004, 293; Stolper 1984.
48 Kaizer 2009; Sommer 2018, 181.
49 Zaccagnini 1983; Roaf 1983.
50 Colledge 1977; Grajetzki 2011; Invernizzi 2012; Langin-Hooper 2013; Stein 2014.

across distant regions during the AoE[51] and universal religious doctrines relevant to people of various ethnicities[52] can be connected to greater movement and intermixing of people of various cultural backgrounds.

Wages and Other Economic Data

While settlement pattern data suggest that mobility increased during the AoE, wage data can be juxtaposed to these data to indicate how labor mobility may have been affected. Wage data for unskilled or low-skilled workers throughout the pre-AoE and AoE have been previously published;[53] we utilized these data to investigate trends spanning nearly three millennia. The data here utilize converted wages to wheat liters/day, which are standardized to make values comparable across different periods. For Mesopotamia, most data derive from cuneiform tablets recording wages, often in grain or equivalent measures. Mostly papyrus and/or parchment data from Egypt similarly record wages using grain measurements. Median wage estimate values for given years are used in analysis, although ranges of possible liters/day are given. In cases where dates are not exactly clear, we have given estimates based on the approximate timeline provided by the sources. In some cases, the dates given are exact. Fig. 5 shows wage data temporally, and primarily covers the regions of southern Mesopotamia and Egypt, which have by far the most data. Egypt and Mesopotamia dominate in our sources for wages, and because of this, another analysis can be done in which all data outside of these regions are removed, as they are often isolated data. Fig. 6 shows only southern Mesopotamia and Egypt from the third millennium BCE until 600 CE. It is noticeable here that the two regions, Egypt and Mesopotamia, begin to converge on between 2–5 liters of wheat/day between approximately 450 BCE and 250 CE. In Egypt and southern Mesopotamia, σ = 4.14 liters/day for wages prior to 450 BCE (2300 BCE – 505 BCE), with an average of 8.42 liters/day, while σ = 1.35 liters/day for wages between 450 BCE and 250 BCE, with an average of 3.1 liters/day. The data generally show less volatility in wages and less dispersion after the mid-first millennium BCE, reflecting a potentially stabilizing effect of migration on wages. Further evidence for convergence might be suggested by Roman wage data for unskilled workers. Estimated unskilled labor values for the Roman Empire between 20–301 CE

51 Gzella 2015; Horrocks 2010.
52 Ulansey 1991; Berkey 2003; Drake 2005.
53 Harper 2016; Stol 2016; Civil 2011; Jursa 2010; Rathbone 2009; Scheidel 2009; Spalinger 2006; Farber 1978; Hallock 1969; Appendix A:4.

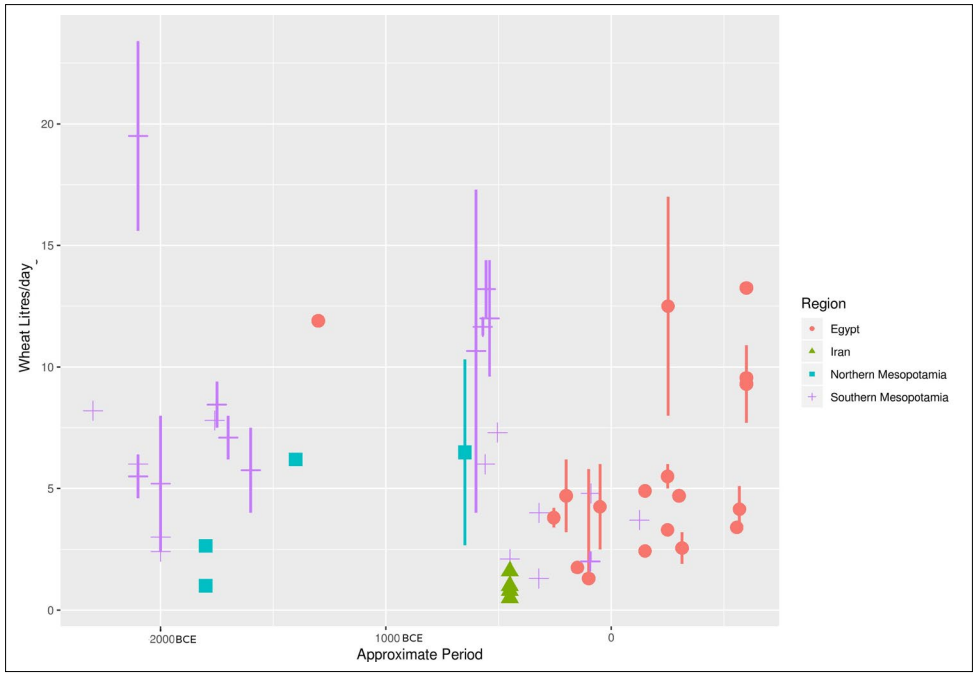

Fig. 5 Wage data and ranges in wheat liters/day for Northern Mesopotamia, Southern Mesopotamia, Iran, and Egypt from the third millennium BCE until 600 CE.

ranged between 1.07–4.35 liters of wheat/day,[54] with the average of these data being 2.23 liters/day; somewhat lower than the Near East and Egypt data, but also showing less variation than data from before 450 BCE.

Between 252–600 CE, greater variation in wages (σ = 4.23 liters/day) is evident, with relatively more limited data available. Wages are generally higher (μ = 7.43 liters/day) in that time. This may reflect instability or upheaval in Egypt, where many of the data come from, during a period of wide conflict between the Roman and later Byzantine empires against the Sasanian Empire. From the third century CE, increased conflict and trade disruption in Egypt and the Near East are evident.[55] However, much of the higher average is explained by data from around 600 CE. Scheidel indicates that during the final half of the sixth century and throughout the seventh century, higher pay is generally evident for workers.[56] The Justinian Plague (541–542 CE) may

54 Rathbone 2009.
55 Drinkwater 2007; Cameron 1993.
56 Scheidel 2009.

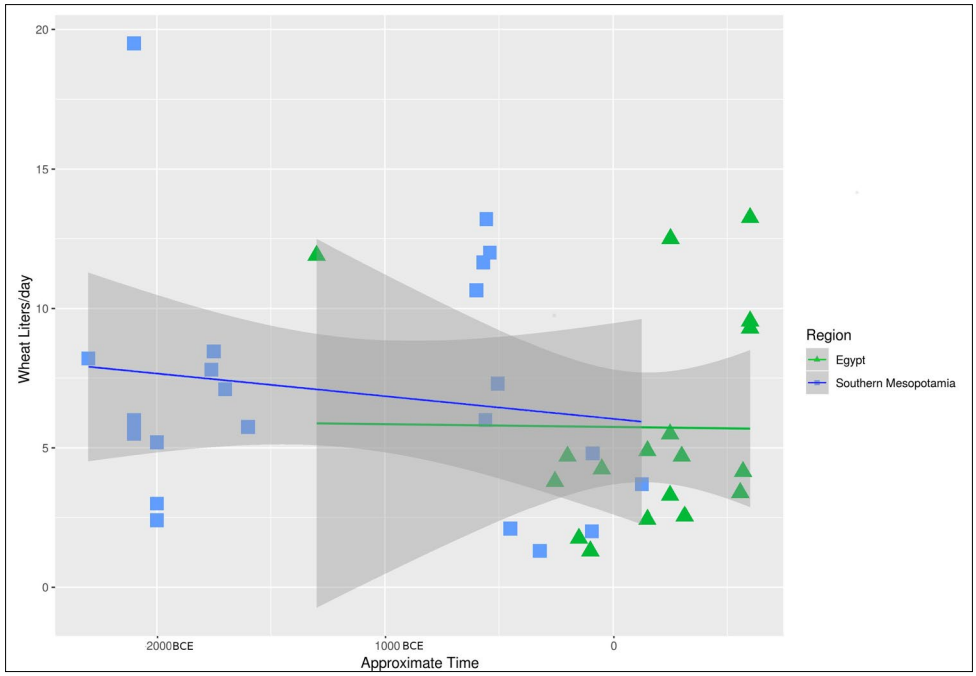

Fig. 6 Median wage data estimates in liters of wheat/day for Southern Mesopotamia and Egypt showing declining wage trends in later periods.

have reduced the pool of available labor across the eastern Mediterranean basin in the mid-sixth century CE,[57] potentially leading to increased wages in its aftermath, at least for a few decades. Nevertheless, outside of the period between the mid-third century CE and 600 CE, particularly between 550–600 CE, the overall and long-term trend was towards a decline in wage rates where rates also became relatively stable during long intervals in the AoE. Overall, the average unskilled wage was about 3.86 liters of wheat/day from about 450 BCE to 550 CE, increasing to around 4.78 liters/day if data from after 550 CE are included. Data variation is also relatively low between 450 BCE–550 CE, with results showing σ = 2.61 liters/day. Overall, these results are still well below pre-450 BCE wages (average of 8.42 liters/day and σ = 4.14 liters/day). Appendix A:4 provides the wage data discussed and relevant references used.

57 Harper 2016.

Agricultural Output and Productivity

To supplement data on wages, evidence for increased agricultural activity, namely, intensification and/or extensification of agriculture, could demonstrate the need for more unskilled laborers and, therefore, more labor migration, at least for some regions. Once again, the evidence mainly comes from southern Mesopotamia, although Egypt also provides some important data. In both cases, intensive and/or extensive agriculture is evident. In southern Mesopotamia, increased seeding rates are evident: they were 4.63 L/ha of seed from about 2000–1700 BCE and increased to 7.1 L/ha in the sixth century BCE. Yields also generally increased from around 861 kg/ha to 1071 kg/ha over the same period.[58] Plough teams also covered a smaller area in the sixth century BCE, as crops were more tightly planted. Teams in the sixth century BCE typically covered between 18.75 to 37.5 ha per day, while in the Ur III (ca. 2100–2000 BCE) period, teams covered 39 to 52 ha.[59] This may have occurred because crops were more tightly planted, requiring tighter turns of the plough within smaller areas. This suggests that more labor was also likely needed to manage and work fields that were more intensively cultivated, which would have the benefit of increasing yields per hectare. Other data suggest that potentially intensive or extensive agriculture continued into later periods. Recent archaeological and botanical evidence from northern Babylonia in the late first millennium BCE and early first millennium CE suggests the existence of extensive date palm cultivation around major canal/irrigation systems.[60] In this case, phytoliths, which are remains of plant materials, demonstrate a large presence of cultivated date palms. Phytoliths also indicate more intensive use of irrigation in the early first millennium CE relative to earlier, pre-AoE periods. Yields for date palm crops could exceed over 5000 L/ha, but its cultivation required intensive labor and a large labor force.[61] Dates would have been a specialized product that would have also been an important item of exchange.[62]

In Egypt, documentary data from the Roman period, between the first and third centuries CE, suggest grain yields were between 7 : 1 and 16 : 1 in terms of yield-to-seed ratio, suggesting higher productivity than other regions in the Mediterranean, including the central part of the Roman Empire in Italy.[63] In the Fayum region of Lower Egypt, particularly high yields were achieved through crop rotation. Given that the technological level would have been approximately equal throughout most Mediterranean regions, it was likely that, in Egypt, a larger work force was needed to achieve

58 Jursa 2014, 118.
59 Halstead 1990, 189.
60 Altaweel et al. 2019.
61 Pirngruber 2017, 106.
62 Van der Spek and Leeuwen 2014; van der Spek 2004.
63 Rowlandson 1996; Rathbone 1991.

higher yields and to maximize production, particularly for grain that was exported to places such as Rome. More fertile fields would certainly have aided production, but substantial labor would also have been needed to take advantage of this fertility.

Archaeological data also suggest more intensive/extensive agricultural activity in the Levant, specifically in the form of new and improved designs for olive presses. The simple olive oil presses of the Late Bronze Age (that is, before the AoE), composed of a circular basin or a flat pressing surface, shifted into more elaborate lever presses in the AoE (from the seventh century BCE onwards), representing an increase in production from about three liters to about twenty liters of oil produced in any single use. This is accompanied by an increase in the number of attested presses during the AoE compared to previous periods.[64] The seventh century BCE site of Ekron, in the Southern Levant, was the best attested example of such an increase; its 115 presses were capable of producing around 500 tons (about 548,500 liters) of olive oil.[65] These olive presses indicate higher production rates and possibly a more specialized agricultural economy in relation to olive and olive oil production. Overall, the seventh century BC Southern Levant shows patterns of agricultural specialization, with coastal areas devoted to wine and olive oil production and internal areas devoted to grain production.[66] More changes in production technologies occurred later in the AoE, and these may also be proxies for increased or, at least, more intensive agricultural activity, both in the Levant and in the Mediterranean. Starting in the second half of the first millennium BC, new and more efficient designs for processing grain were introduced, such as the Olynthus mill, the Pompeian mill, the rotary mill, and, during late antiquity, the screw-press for wine production, all of which represented great technological steps upwards compared to pre-AoE production technologies.[67] These new production technologies greatly improved the output of typical Mediterranean and Levantine agricultural products such as flour, olive oil, and wine. They may be considered to have been essential to the higher level of production needed to meet the increased demand for specific agricultural goods, including trade of specialized agricultural goods, that emerged during the AoE and that also required an increase in laborers, despite the greater efficiency in the processing of agricultural goods. Large numbers of laborers would have been needed to tend and harvest the higher quantities of fruits and grains that could now be processed. A boost in processing capability may have meant that more labor was needed for harvesting to meet export and domestic demands.

64 Eitam 1987.
65 Eitam 1996.
66 Faust and Weiss 2005.
67 Alonso 2015; Frankel 2019; Lewit and Burton 2019.

Discussion: Movement and Labor

We contribute to the understanding of migration and labor by presenting varied empirical evidence for changes to labor wages and associated population mobility and other data affecting agriculture and settlement. The work argues that labor migration enabled declining unskilled-labor wages and wage convergence, which is evident particularly during the second half of the first millennium BCE and going into the early centuries of the first millennium CE in areas such as Babylonia and Egypt. Wages have been seen as related to key historical events and changes, with wars and diseases being included in the major causes of their fluctuations.[68] Easier population movement between regions, we believe, has the effect of increasing labor supply, which results in decreased wages and generally stable and equal wages across wider areas. Wage volatility is subdued when the labor supply is high and mobility is maintained.[69] Hence, population movement may have also had an influence on wage inequality, where declining relative wages are evident. In the recent past, convergence in wages has been one result of increasingly mobile labor.[70] Taylor and Williamson indicate that convergence in wages was the primary pattern evident in wages in OECD countries in the late nineteenth century.[71] Wage convergence is also evident in the twentieth century due to migration, including wage convergence within a single country, such as in the United States when African American populations began to migrate from the southern parts of the United States to northern cities.[72] We suggest a similar effect occurred in Egypt and Mesopotamia during the AoE. Although increased demand for labor could have counteracted declining wages or, at least, dampened the effects of an increased supply of labor in some regions, wage convergence is a likely outcome when workers gain the ability to travel longer distances and communication is facilitated. It is possible for various reasons to witness increased wages, such as during the Justinian Plague, but for Egypt and Mesopotamia, the wider trend indicates declining wages as having been evident. Increased labor mobility can also provide greater wage stability through a steady supply of labor, which can offset shocks such as the mass loss of workers in times of war or disease. This may not have always been the case, such as during the Justinian Plague, which also occurred during a time of conflict between the Sasanian and Byzantine Empires that potentially prevented increased labor flow. Additionally, a widespread plague may have meant that labor numbers would have declined over very wide areas covering the eastern Mediterranean and beyond.

68 Scheidel 2017; Harper 2016; Scheidel 2009.
69 Roy 2007.
70 Boyer 1997; Williamson 1996.
71 Taylor and Williamson 1997.
72 Boustan 2009.

However, we can see that, for long periods between 450 BCE–550 CE, populations could more easily move between Egypt and Mesopotamia, enabling some potential insulation against labor wage shocks.

Movement data from settlement patterns, which provide data on settlement structure and size, indicate increased population mobility, which allowed for easier flow of labor across greater distances. This movement was not uniform: it resulted in a high population concentration in some areas, such as along major rivers (e.g., the Tigris and Euphrates; the Babylon and Ctesiphon) and the eastern Mediterranean (e.g., Antioch), while other regions, such as the interior of the Near East in eastern Syria, had relatively lower population densities.[73] The timeline for when wages for labor grew more uniform (or converged) is not clear, but we see that in Babylon, by the sixth century BCE (and possibly earlier) and during the Roman Period in Egypt, there was high demand for specialized agricultural products and evidence for intensive/extensive production. We have the clearest evidence for wage convergence in the years 450 BCE–250 CE, possibly continuing to about 550 CE, with similar rates of pay for unskilled workers in Egypt and Mesopotamia and only slight wage volatility. Wages between 250–600 CE show relatively lower volatility than the pre-AoE, although they are generally more volatile and higher than 450 BCE–250 CE. Egypt and Mesopotamia belonged to the same state in the fifth and fourth century BCE, which would have facilitated an easier flow of labor. That period may have represented the most likely period when wages would be the most similar between these two regions, although this is not certain given the lack of data in both regions.

Although shorter-term volatility in labor supply and wages were likely, due to the effects of war, instability, and disease, the results demonstrate a general, long-term trend of lowering wages that align across time and space. Other regions, such as the Levant, show similar agricultural intensification as Mesopotamia and Egypt, suggesting potentially comparable patterns in wages. However, in these cases, we have fewer data on wages; hence, it is difficult to track wage trends in an area such as the Levant from the pre-AoE into the AoE periods. Decreasing wages are particularly evident in Babylonia, where we have dates from both the pre-AoE and AoE periods, although the extent to which such a decrease can be extended to other areas is not clear. Settlement data and agricultural production and specialization from areas other than Babylonia do suggest greater labor mobility that would have been required for at least some of the periods within the AoE. Additionally, coastal regions in the eastern Mediterranean, Egypt, and southern Mesopotamia witnessed greater urbanization during the late first millennium BCE and early first millennium CE, suggesting more labor and increased agricultural demand in those areas. The pattern witnessed in southern Mesopotamia

73 See Mazzoni 1991–1992.

and, to some extent, in Egypt may have occurred in surrounding regions, although evidence for long-term wage patterns are lacking.

Similar to more modern cases, we find evidence of increased population mobility driving urban growth, whereby a select number of cities grew far larger, with increased disparity in urban size, as indicated by Gini coefficients and lower β to indicate easier mobility. Agricultural specialization, including agriculture for export, while becoming more efficient in production, still required a large labor pool that would have motivated some of the migration required for labor demands. Overall, settlement patterns indicate more mobile populations that could allow agricultural regions to specialize in the AoE. As conurbations such as Babylon and the Ctesiphon urban zone grew, wages appear to decline and become more similar to those in regions such as Egypt.

Conclusion

This work contributes to the literature on universalism, empires, population mobility, and historical economics by introducing evidence for labor migration. Even though Egypt and Mesopotamia often were part of different states during the AoE, common cultural themes, such as Hellenistic influences during the Ptolemaic and Seleucid Empires, indicate close cultural interaction or even a type of cohesion. This could be a form of '*asabiya* or cultural cohesion,[74] although it did not often lead to a single large state dominating the entire eastern Mediterranean. Nevertheless, commonalities evidently did allow more intense cultural interaction through common languages and other shared cultural values (including religion), with migration being central. In modern labor markets, affected by trade agreements and easing of labor flow, such as in European Union member states, converging trends in wages are evident.[75] In these cases, relatively open borders enable greater labor mobility, which can lead to wage convergence across member states in a labor market. We cannot suggest that the AoE labor market and systems such as the modern EU are very similar, but there could be similar effects on wages in both due to higher labor mobility compared to what preceded each system. Universal empires, which encourage greater migration and population integration or even cohesion, and modern labor and trade agreements both help to diminish labor flow barriers.

Future work could focus on collecting more archaeological and historical metrics to demonstrate more clear evidence for wage convergence and the role of labor migration. Building a model that demonstrates the relationship between mobility

74 Turchin 2003; 2005; Ibn Khaldun 2013.
75 Zhou and Bloch 2019.

and wages is one potential outcome that might be more achievable if more data are collected. Previous work has already collected data on wages; however, one major challenge is that collecting wage data on skilled workers is complex, since specific roles do not always correspond across different periods. Data that help to establish clearer settlement patterns across a wider area covering the Near East and Egypt, including with better and more precise dates, could also support current evidence on population mobility. Historical data for other regions, that is, outside of the Near East, and discussing economic events and migration could certainly benefit research demonstrating the presence of convergence and/or increased labor mobility across even wider regions. Another focus for future work could also be the interaction between capital (wealth) flow and wages in different areas of the Near East and Egypt during the AoE. This could be analyzed in the framework of changing trends in wealth disparity, both within primate cities and between cities and their surrounding regions. Capital flows would affect investment and where wealth would concentrate and attract labor. Finding their relationship to labor flow is relevant for scholars interested in wages and economic/social inequality in the past.[76] For now, the contributions we make relate to integrating wage and mobility data using settlement patterns. Juxtaposing these data with qualitative and other data suggests that a relationship between wages and mobility is evident in the AoE.

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Figure Credits

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76 E.g., Levitt 2019.

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