Mathematical Economics of Human Capital in the Middle East in Long-Run Perspective

Dissertation

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Symbols and Abbreviations

ABCC The numeracy index that equals the share of the individuals who reported their ages accurately

GDP Gross Domestic Product

IPUMS Integrated Public Use Microdata Series

LSDV Least Square Dummy Variable

MZES Mannheim Centre for European Social Research

OLS Ordinary Least Squares

Wh Whipple Index that measures the age heaping

Country abbreviations according to **DIN ISO 3166**

1. Introduction

"The value of a business is a function of how well the financial capital and the intellectual capital are managed by the human capital. You'd better get the human capital part right."

Dave Bookbinder (2017)

1.1 Human capital and its measurements

Human capital plays a core role in economic development. It is the main tool used to control the other kinds of physical capital and is an important motivator of technological and scientific development; a prerequisite for economic growth (Becker, Murphy and Tamura 1990). Returns to investment in human capital are far larger than returns to other physical capital types (Schultz 1989). A higher human capital leads to higher growth rates (Romer 1990). However, human capital is not simply defined because of its close relationship with the population as a whole; it cannot be separated from the people and their abilities (Becker 1975). Human capital refers to human beings themselves, their knowledge, health, skills, values and intellectual abilities (Becker 1975). It is mainly produced by the parental time invested in children's education (Becker, Murphy and Tamura 1990).

Just as it is difficult to define human capital, it is also challenging to measure it. Researchers have suggested the following indicators to calculate human capital: Education is the most widespread indicator for human capital, and to specify basic educational attainment, literacy rates can be used (Romer 1989). Literacy rates reflect the proportion of population that has basic reading skills. In cases where there is no information as to whether individuals are literate or not, signature rate proxy can be used (Reis 2005). People who could sign their full names in the past were able usually to write, so we can use this proxy for literacy and therefore human capital. Years of schooling is also a good measurement for

human capital (Barro and Lee 1993), although school attendance rates are not a perfect measure of skills acquired in the past (Mokyr and Voth 2010). Baten and van Zanden (2008) used a different approach to measuring human capital: book production per capita. Human capital refers not only to the education and intellectual skills that an individual has acquired, but it also reflects the condition of the population's health. Human stature is used to study the state of welfare and health, the availability of food and access to nutrition leads to taller populations (Stegl and Baten 2009).

As an analogue of literacy, the word "numeracy" was added to the English language (Cohen 1982) to define the skill of dealing with numbers. Unlike mathematics, numeracy does not involve abstraction; it involves the use of numbers, calculations or diagrams in order to simplify social interactions (Barwell 2004). In this thesis, however, numeracy will be defined as the basic ability to calculate, as possessing numerical skills allows a person to do simple calculations, making them numerate. In this thesis, numeracy will be the main feature of analysis that reflects education, in order to measure human capital.

The age heaping is an established method of determining a population's numeracy level and therefore proxy educational attainment (Mokyr 1983; Manzel 2007; A'Hearn, Baten and Crayen, 2009; Manzel and Baten 2009; Crayen and Baten 2010). The concept of age heaping refers to the phenomenon of reporting inaccurate ages when individuals are asked their ages. Individuals tend to round their ages up or down to multiples of five. This age heaping phenomenon might be caused by not knowing their exact birth date or because of low numerical skills. If people have low numerical skills, they might not be able to calculate their ages accurately, even if they know their birth dates; therefore, rounding them to multiples of five. The accuracy of determining ages will be used as a proxy for numeracy in this thesis. A robust negative correlation was found between age heaping and literacy levels

in numerous studies (Myers 1954, Hippe and Baten 2012). Therefore, the age heaping technique is used as a proxy for numeracy in order to measure human capital. The index used to calculate the extent of age heaping is the Whipple index, which is calculated by taking the ratio of the number of all rounded ages (multiples of five) to the expected number of rounded ages (which is the fifth of the whole sample under study).

$$Wh = \frac{\sum(n_{25} + n_{30} \ldots . + n_{70})}{\frac{1}{5}\sum(age\ 23 + age\ 24 + age\ 25 + \cdots + age\ 72)} \times 100$$

In the worst case, when all individuals report rounded ages, the Whipple index value will be equal to 500. If the population could report their ages accurately and only 20% of them report ages as multiples of five, as expected, a value of 100 will result. Only when no one at all reported a rounded age does the zero case happen.

In order to make the Whipple index simpler to explain, A'Hearn, Baten and Crayen (2009) introduced a transformation of it. They called this transformation the ABCC index and provided the Whipple index with an interpretation of values between zero and a hundred.

$$ABCC = \left\{1 - \frac{(W - 100)}{400}\right\} \times 100 \quad if\ W \geq 100;\ else\ ABCC = 100$$

If all individuals report rounded ages, the value of Whipple index will equal 500 and the ABCC value will be equal to zero. While, in the perfect case, if all people could calculate their ages correctly, the ABCC value then would reach one hundred; reflecting perfect basic numerical skills in the studied sample. We can conclude that these people all have basic numerical skills because of basic education they gained as children.

Even though Thomas (1987) declared that numeracy, unlike literacy, has no natural measurement, the age heaping method is a useful way of solving the problem of absent data in economic history studies over the long run. By relying solely on age records, we can obtain an overview of the basic numerical skills of the population.

1.2 Aim of the Thesis

The Middle East covers a variety of countries that are richly diverse in their own cultures, religious practices, ethnicities and geographic characteristics. Although they differ greatly from one another, they also have similarities and a shared history that shaped their development paths over time. The main goal of this thesis is to focus on human capital development in the Middle East, to study its determinants and shed light on the obstacles that it faced. A secondary goal is for further research to be able to benefit from our findings in future studies of human capital in the region; to learn from history and steer the future of human capital development in the right direction.

1.3 Outline of the Thesis

This thesis contains seven chapters, one of them (chapter two) was already published in "A History of the Global Economy" (Baten, J. (Ed.). 2016) in 2016. Chapters three and six are intended for publication in the near future as research papers. The main topic on which all chapters are based is the human capital development of the Middle East.

Chapter two covers human capital development in the Middle East, North Africa and South Asia over the long run (1500-2010). The countries in this geographic region experienced multifaceted development in this period and experienced great heterogeneity in their development. We study development through the Medieval and early modern periods, and argue that living standards in the region were almost equal to those in most of Europe, particularly in the fields of technology, medicine and in the social sciences. We then study the backwardness of the eighteenth century before going through to the reform period during the early 19th century. At this time, Turkey was opened up to European competition after the Tanzimat reforms while Egypt implemented a variety of reforms in its

economic activities and other regions faced direct colonialization, such as Central Asia, the Caucasus and Algeria. The deindustrialization of the Middle East and its possible causes during the 19th century is also studied in this chapter. To study living standards, we first examine the development path of GDP and, secondly, human stature of the region – we do this by analysing the development of heights as a signal of welfare. During the 20th century, we cover the reindustrialization period. Indicators of human capital in this chapter are numeracy, years of schooling and life expectancy. We also study the development of GDP before and after oil production in the region. All these aspects together enable us to gain an overview of the development of the Middle East throughout the last five centuries.

In chapter three, we study whether there was a "Curse of Resources" in the Middle East and South Asia. We do this by testing whether there was a negative influence of oil production on human capital development in the region during the 19th and 20th centuries. We compare the trends in numeracy and years of schooling within the countries under study in order to evaluate whether there was any divergent behaviour between those countries over time. We include explanatory variables in our research such as the growth in GDP per capita, fertility rates, religious characteristics and colonial features, taking time fixed-effects into consideration in order to measure the influence of oil production on the human capital development of the region.

The main goal of chapter four is to shed light on human capital development in the Ottoman Empire during the nineteenth century. By using individual census data from inhabitants of the Ottoman states in today's Turkey, Syria, Iraq and Palestine, we can examine the numeracy development of those states and test the influence of factors such as the size of cities, their locations, their population's religions and their ethnicities. The main focus is on the differences in numeracy between the Arabic and Turkish populations.

Chapter five addresses the question of whether separating religion and government leads to a positive influence on human capital – 20th century Turkey is used as a case study. By using province level data and the age heaping technique, we test the influence of secularism on human capital in Turkey and compare the results to those in neighbouring countries. The second question in this chapter is, was the influence of secularism the same in all Turkish regions regardless of their ethnic majorities? We also study the influences of other factors such as religion and gender on the development of numeracy in the Turkish provinces before and after the secular reforms.

The development of numeracy in Egypt during the 19th century is covered in Chapter six. This chapter aims to study numeracy using the age heaping technique on an individual level using census data. In addition to studying geographical differences, the main focus is on the influences of religion, gender and occupation on the numeracy level of the Egyptian population.

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2. The Middle East, North Africa and Central Asia 1500-2010

2.1 Introduction

In recent years, the Middle East and North Africa region has been characterized in newspaper reports by its many conflicts between religious and political groups. To understand the present situation, it is important to study the region's development over the last few centuries. The first impression of Middle Eastern history is the great heterogeneity of its development. We cover the geographic region between Morocco and Afghanistan (including the former Soviet Republics in Central Asia and the Caucasus that have a substantial Muslim population). These countries have experienced multi-faceted development over the past five centuries. However, prominent economic historians of these world regions, such as Charles Issawi (1982), have distilled some common features that characterized many of the Middle Eastern countries. One common factor was contact with Europe during the nineteenth century, which Issawi described as a "challenge". Just before WWI, European merchants (and sometimes their governments) had taken over many important positions in Middle Eastern economies outside agriculture. In contrast, Issawi interprets the developments during the twentieth century as a "reaction" in which many Middle Eastern political leaders aimed at reducing the European influence. They also tried to mitigate the role of religious minorities in economic core positions of their countries.

This chapter is coauthored with Jörg Baten and it was published as a chapter of the book: A History of Global Economy 1500 to The Present, edited by Jörg Baten: Ghanem, R. & Baten, J. (2016). The Middle East, North Africa and Central Asia 1500-2010, in Baten, J. (ed.), *A History of the Global Economy: 1500 to the Present*, Cambridge University Press, 208-239.. The concept of this paper and the writing were 50% on my behalf, to 50% on behalf of Jörg Baten.

Since Issawi and Owen (1993) wrote their famous overviews in the 1970s and 1980s, some progress has been made in the quantitative analysis of long-run economic trends of the Middle East. Most famously, Şevket Pamuk has presented his estimates of urban real wages and national income estimates for a number of countries in this region. Coşgel and Ergene (2012) have studied the development of early modern inequality based on tax registers for Northern Anatolia and additional sources. Others have focused on complementary issues that are discussed below. Another theme that was studied with considerable effort was the development of the "biological standard of living".[1] The development of human stature can serve as an indicator of two key welfare components, nutritional quality and health. This development was reconstructed for a number of Middle Eastern economies. The Middle East actually had a relative advantage over Europe during the middle of the nineteenth century (Stegl and Baten, 2009). Since the 1880s, however, there has been a dramatic change in the biological standard of living relative to Europeans. It seems plausible that this shift in relative welfare also influenced a deep feeling of injustice in the Middle Eastern population.

Finally, we draw on new research about trends in education and human capital. Though education in the Middle East was quite developed during the High Middle Ages, various available indicators suggest that Middle Eastern governments and families underinvested in this core determinant of economic growth and competiveness during the period beginning with the late Middle Ages. Additionally, the differences among countries within this region of the world were substantial, and interesting to study in themselves.

[1] The main indicator is human stature (see below). The term was first used by Komlos; see chapter "Introduction" in Baten, J. (Ed.). (2016). *A History of the Global Economy*. Cambridge University Press.

2.2 Medieval and Early Modern period

During the Medieval period, the technology of the Middle East was superior to that of Europe and knowledge was flowing from the former to the latter. A good example is medical knowledge. Not only was the ancient knowledge kept in libraries of the Middle East, but physicians also developed it further. This early progress is visible in urbanization rates: Bosker, Buringh and Van Zanden (2013) recently estimated the urban share for the geographic area of the Middle East and North Africa compared to Europe (Figure 2.1). Clearly, urbanization levels were much lower in Europe. They increased at roughly the same pace as in the Middle East until approximately 1100. Even if the Middle East remained more urbanized until 1700, its urbanization apparently reached a plateau after 1100. During the late medieval Mongolian invasion and plague episodes, it even temporarily declined. In contrast, Europe was converging during the period 1500-1800, and finally overtook the Middle East in 1800 (but note that the later Russian Empire and Scandinavia are excluded, which would reduce European urbanization).

As it is typical for World regions that have achieved technological and economic leadership in a certain period, the Middle East saw the formation of large empires, beginning with the Arabic ones of the early medieval period. The Ottoman Empire massively expanded in the fifteenth century toward the Balkans and Southeastern Europe, and in the sixteenth century toward the East and North Africa. In the seventeenth century, it stretched from Bosnia to Iraq and the Arabian Peninsula. In North Africa, only Morocco remained independent. The reasons behind the geographical expansion of the Ottoman Empire have been studied in recent research from a new perspective. Iyigun (2013) analyzed the directions of imperial expansion based on the cultural influences of the Ottoman ruler's family. While male lineage was mostly predetermined, the Sultan mother was typically a

former slave, often a convert who was born in Europe. Because the Sultan's mother educated the prince, she provided her son with some cultural preferences that influenced the direction of territorial expansion. For example, fifteenth-century mothers were of Turkish origin, with only one female slave from Albania in between. The ethnic backgrounds of the Sultan's mothers during the sixteenth century were different, as one Polish and two Italian women became concubines and later prince's mothers.[2] During the eighteenth century, the pirates of the Western Mediterranean provided French female slaves (as well as Italians and women from the Balkans); some of these later became Sultan's mothers. Iyigun (2013) argues that this composition influenced the direction of territorial expansion, specifically, the shift away from Christian target territories between the fifteenth and sixteenth centuries toward the regions of the East, and back again during the seventeenth century.

The quantitative evidence on the economic history of the Middle East during the early modern period is quite limited. Many historians have speculated that it was a period of decline. They came to this conclusion by noting that the Islamic Empires of the High Middle Ages were powerful and their scientists very progressive, while travel reports from the eighteenth century largely portrayed an image of backward technology and poverty. However, it is not clear whether the development was really an absolute decline rather than a relative one. It might have been that the level of eighteenth century development was simply somewhat lower than in Northwestern Europe (that had developed enormously) because the latter was the basis of comparison.

Trade routes between medieval Europe and Asia that had passed the Middle East shifted. This was one of the major events in Middle Eastern economic history (Findlay and

[2] In the seventeenth century, many Serbian women also entered the Harem and became Sultans' mothers, in addition to one Russian and one Greek. However, during this century, there were also Bosnians and one Albanian who might have come from Muslim families.

O'Rourke 2007). During the Middle Ages, the Middle East earned monopoly profits from the trade of Asian spices and luxury goods with Europe. In the early modern period, these monopoly profits flowed first to the pockets of the Portuguese, then to the Dutch, and finally to the British and French. However, the merchants of the Middle East also found additional sources of trading income such as the trade of Yemenite coffee (Raymond 1973, cited from Owen 1993). This change in trade routes could not have had a very large influence on Middle Eastern economies because trading income affects only a small part of the population.

Beside the effects of shifting trade routes, there were medieval and early modern demographic shocks; Borsch (2005) argued that the late medieval plague events and the Mongol invasion hit the Middle Eastern irrigation economies in Iraq and Egypt particularly hard because they needed a critical mass of population density to keep up the irrigation systems. The Mamluks who were ruling Egypt in a "predatory" way (Findlay and O'Rourke 2007) were even less willing to invest in the public works that were necessary for irrigation, as the number of peasants and hence the rents for the Mamluks dropped after the great plague. While the plague increased real wages in Western Europe, it might have had detrimental effects in the irrigation-agricultural parts of the Middle East.

In spite of these interesting hypotheses, information regarding early development in the Middle East is based on quite fragmentary data. Özmucur and Pamuk (2002) developed more solid evidence on real wage developments in Istanbul and other large cities. They found that in general, the development of urban craftsmen's wages was on a level similar to Southern and Central Europe during the sixteenth to eighteenth centuries (Figure 2.2). Clearly, the rich European northwest had already left Istanbul behind. However, compared with other European cities, Middle Eastern urban centers maintained a similar welfare level. Özmucur and Pamuk stressed the fact that their estimates referred to a specific social group,

and it might not be so clear how other groups of society were developing. However, we would interpret this evidence as plausible support of the view that living standards were at least equal to most of Europe until the eighteenth century.

Nevertheless, the scant evidence that we have on human capital formation suggests that the Middle East did not participate in the European human capital revolution. Evidence regarding sixteenth-century Maghreb suggests that basic numeracy equaled only 10 percent in the late fifteenth/early sixteenth century, and reached approximately 50 percent in the period between the late sixteenth to early eighteenth century (Juif and Baten 2013). For eighteenth-century Turkey and Syria, we have estimates in the range of 10-50 percent (Baten and Ghanem 2014). In the same period, numeracy in Europe grew from approximately 50 to 90 percent. Hence, Europe emerged as a dramatically strong competitor.

2.3 Limitations to the 'rule of law' at the beginning of the nineteenth century

What characterized the Middle East at the beginning of the nineteenth century? Many contemporary observers noted the complicated institutional structure and sometimes the missing "rule of law" (reviewed in Kuran 2011). Taxation capability was low and rulers often were exploitative; in many cases their ethnic background differed from those of the ruled (in Iran and Egypt, for example).

However, some regions actually benefitted from low levels of the rule of law, such as the Maghreb pirates. In Algeria and Tunisia, an important additional element was the pirate economy of the seventeenth and eighteenth centuries. Originally created by a tradition of holy war against the Christians, privateering was developing into an industry for the Algerian

and Tunisian port cities.[3] Ships whose owners were not willing or able to pay a substantial fee were captured, and the surviving personnel sold on slave markets if no ransom was paid. Some Christians who accepted conversion also joined the corsair fleet as renegades. Contrary to the reputation of privateering, corsair activity was a well-organized business. It involved many different actors. As for Tunis' pirates, a pirate crew consisted of at least the ship owner, captain, naval crewmen and armed warriors. The latter were mostly former hostages. Although the hostages were violently taken, many later joined the pirate business and benefitted from it. Through the trade of booty, they not only acquired wealth but also rose in social rank. Tunis as an expansionary city of that time welcomed foreigners in its midst and, in return, gained economic profits. Algerian pirates sailed as far as Northwestern Europe for slave raids.

In the irrigation economies of Egypt and Mesopotamia, clear property rights and the rule of law would have been most important, because irrigation agriculture is particularly dependent on clear institutional settings. But even here, property rights were not always clearly defined.[4] It is very important to understand the structure of property rights to land in the Middle East, and in Egypt and Iraq in particular.[5] In general, land rights were very complicated (Owen 1993). In principle, the state owned most of the land except for some gardens, orchards and the real estate on which the houses and the villages stood. However, many families had already begun using some legal tricks to imitate something like private

[3] See Larguèche (2001).

[4] The wealth of Arabia consisted traditionally mostly of its goats and sheep. Also famous were the horses and camels. Oman developed a significant trading position with up to 2000 ships moving between India and Southern Africa in the early nineteenth century. Some mines for copper and lead existed. Yemen specialized in the production of coffee. This country was politically heavily contested and suffered from several conflicts.

[5] See on the following Owen (1993), Mokyr (2003) and Issawi (1982).Grain was certainly the most important agricultural product. Additional crops included flax, tobacco and opium. The famous Nile inundations helped achieve relatively respectable grain productivity. The other irrigation economy of Mesopotamia (today's Iraq) was also mainly oriented toward grains. However, the rivers were slightly more difficult to handle in Iraq. In particular, they delivered floods in the "wrong" month, in April and May. This was too late to irrigate the winter crop. However, it could destroy unprotected fields. In addition, the Tigris and Euphrates rivers flooded very quickly in spring, coming from the northern mountains, sometimes causing rivers to move permanently to new channels. In addition to the mentioned grains, large numbers of dates were grown in the south of Mesopotamia around Basra.

family ownership at the beginning of the nineteenth century. Generally, the most secure property rights were established in the Mount Lebanon area, and partially so in Anatolia, Lower Egypt and parts of Syria. In contrast, in Southern Syria, Upper Egypt, Mesopotamia and Palestine, we have communal redistribution of land. Each peasant received a new plot of land after the harvest season. Quasi-private ownership was impossible in this communally organized land tenure system, of course. Only toward the mid-nineteenth century was there a tendency toward imitating private ownership in these regions. While most of the land was owned by the state, local rulers could obtain a large part of the tax revenues. In principle, the rules said that between 10 and 50 percent of the production should be taxed, plus some additional duties. However, this was only a theoretical tax rate. In practice, a peasant's skill in hiding part of the production was very important, and those who were more skilled at hiding were able to achieve a higher standard of living. Tax evasion was quite common, and tax payers considered this to be legitimate because they received almost no public goods in return. For example, there was little protection except perhaps against other local lords. Therefore, the peasants protected themselves in fortified villages.[6] The roads and other infrastructure were in a relatively poor state at the beginning of the nineteenth century, and the irrigation systems were not centrally surveyed.

Iran, with its long history of early cultures and Empires, had suffered particularly hard during the late Middle Ages and the early modern period. Many invasions of nomadic tribes, whose leaders became rulers in this country, affected it negatively. The relationship between these rulers of nomadic origin and the peasants and merchants of Iran was always difficult; therefore, their ability to raise regular taxes was low. Hence, arbitrary confiscations were often used. Relatively unsecure property rights and governmental preference for

[6] There were even special towers without doors and windows in Mesopotamia. Some of the peasants also aimed at creating temporary alliances with Nomads in order to prevent tax collectors from taxing a large part of their production.

nomadic tribes resulted in a reduction of irrigated land and an increase of pastures and wasteland before 1800.[7]

2.4 Urban craftsmen and transport infrastructure around 1800

In contrast to Western European proto-industrial production in the countryside, industrial production in the Middle East was mostly concentrated in the cities. Trade in the famous souks, as well as administration, were the other main functions of the urban centers. With the exception of Istanbul, the cities themselves were all situated next to a substantial area of cultivatable land with reasonable soil quality (see Owen 1993). Textile production was the most important industry, complemented by food-processing, furniture and specialized industries in some places.[8] Even though technological progress in production was slower than in Europe, some industries – such as Turkish armament producers and shipbuilders – could produce goods at similar levels of quality to those produced by Europeans (Owen 1993, p. 46). Obviously, the military interests of the Ottoman Empire required such exceptions. Most other industries, with fixed price systems and guild systems in which old masters typically commanded younger apprentices, were not conducive to innovation, even if a certain quality of craftsmanship was preserved.

Another very important urban function was to organize caravan trade. Complemented by coastal and river-based trade, the main caravan routes within the Ottoman Empire connected Syria and Mesopotamia (and from there led to Persia and in some periods to China). A caravan artery went East-West in Southern and Northern Anatolia and from there to Central Asia. Trade goods comprised textiles and spices from India and

[7] During the nineteenth century, the situation of property rights gradually improved, but now population growth was rapid and the imperial interests of Britain and Russia became a challenge for Iran. Although Britain gained considerable influence and Iranian merchants felt that their natural resources were expropriated, Iran never became a formal colony. The Russian Empire was more successful in neighboring Azerbaijan, which later in the nineteenth century provided substantial oil revenues. Russia also expanded into the steppe of modern Kazakhstan and the "silk road" area of central Asia.

[8] Well-known were muslins from Mosul and damask from Damascus, for example.

Southeast Asia in exchange for European manufactures, African ivory, skins, ostrich feathers and similar items, as well as a limited variety of Middle Eastern goods (such as Syrian cotton thread and yarn, and Lebanese silk). Black slaves from Africa were traded northward, and white slaves from Russia and the Balkans were traded southward. Trade within the Ottoman Empire consisted of grain, sugar, cotton and other products from Egypt in exchange for textiles, soap, dyestuffs, and processed food from Syria and Anatolia. Imports and exports of Mesopotamia were relatively limited, but there was quite some transit trade, and Persia exported opium, carpets, and other products. For overland transport, in addition to the regular costs for camels and personnel, safety costs were often large. Bedouin tribes often required “dues” that could be as large as three times the normal transport cost (Owen 1993).

In conclusion, the Middle East at the beginning of the nineteenth century showed complicated property rights and little economic dynamism, although there were exceptions. The systems of production and taxation did not encourage development; nor were land resources completely used.

2.5 Reform period: the early nineteenth century

During the early nineteenth century, the situation in the Middle East changed dramatically. We will focus on three development paths of the nineteenth century: mild reforms and problematic openness in the Ottoman Imperial core, forced development in Egypt, and direct colonization in Central Asia and Algeria.

(1) The famous Tanzimat reforms in the Ottoman core (mainly from 1839) fundamentally changed the law, administration, military and economic situation. Although many fields were affected by the reforms, equality of the citizenry was perceived as one of

the most important. Previously, the Jewish and the Orthodox and Armenian Christians had a particular status with both advantages (as Muslims saw it) and disadvantages (as the minorities saw it). After the reforms, all citizens of the Ottoman Empire should have been treated equally – in theory at least. As an additional component of the reforms, military service was regulated to a maximum amount of five years.

Tax farming, which had been a problematic economic institution, was successively abolished during the reforms. Previously, a rich tribal leader, merchant or feudal lord could obtain the right to collect taxes after paying a fixed amount to the government. This caused substantial overtaxing, leading to conflict and inequalities of real tax burdens because some tax farmers were more effective – and sometimes violent – in their tax collection efforts (but see Coşgel and Ergene 2012). Finally, an important point was the opening of the Ottoman economy to imports. European governments also influenced the reforms. It soon became clear that in many fields of industrial production, the Middle Eastern craftsmen could not compete with their European counterparts, as trade with Europe was intensified.[9]

(2) Egypt had a special and remarkable development during the nineteenth century, mainly stimulated by political changes initiated by Mohammad Ali Pasha. Since Roman times, Egypt had always been ruled by persons born abroad or with parents from outside of the country, and the Albanian Mohammad Ali Pasha was no exception. During the 42 years of his reign, Mohammad Ali reformed the Egyptian state and economy in a radical way (Alshalak et. al. 2006). One of his main aims was to build a strong army that would be able to protect his new state. Reforms were also applied in the education system, again with the motivation to provide the army with educated leaders but also to train Egyptians in the skills demanded by modern industry, trade and administrative positions. Many factories were

[9] Population growth was stimulated by these reforms, as more land was now put to use. Another strong determinant of population growth was the fact that the plague disappeared during the early nineteenth century.

built and new industries developed during the Mohammad Ali period. Plants for the construction of ships, the production of chemicals, weapons and other important products were realized. Apart from factories for military purposes, the textile industry also flourished during this period. Imports and exports were severely controlled because much of the government budget stemmed from trade revenues organized by marketing boards. Agriculture was the focus of the reforms. By changing the land property system, building new dams and watering channels, developing the irrigation system, introducing new crops and controlling planted yields, agricultural production increased substantially during the early nineteenth century.

Mohammad Ali also created a law of mandatory military service to expand the army. In the end, it included almost 4 percent of the population. Egypt had become a military state and participated in many wars during the nineteenth century, such as in Hijaz, Sudan, Greece and Syria. Ali used his oversized army to develop a power position for Egypt. He also intended to provide more raw materials to Egyptian industry. The forced development of military power, agriculture and new industries has similarities to Soviet strategies (but without communism).

Mohammad Ali died in 1848, and his successors adopted different strategies. His son Ismail Pasha encouraged science and agriculture, and decided to ban slavery in Egypt. During the early 1860s, when U.S. cotton producers dropped from the world market due to the American civil war, Egyptian cotton production flourished. During the following period, however, Egypt began to suffer from many disasters including epidemic disease, flood, and wars. Ismail Pasha had to rely on foreign debt to solve these problems, and he could not find a solution to pay back the increasing foreign debt. The Egyptian economy weakened, and the

English and French colonial powers started to increase interventionist policies, until England transformed Egypt into a protectorate in 1882.

(3) Direct colonization took place in Central Asia, the Caucasus and Algeria: Russia began a territorial expansion, first to the northern steppe of the Central Asian region, during the mid-eighteenth century when several Kazakh tribes called Czarist troops for support. While the Kazakhs interpreted this event more as a temporary alliance under Russian supremacy, the Czar now considered the northern steppe to be part of the Russian Empire; however, the Imperial administration started to integrate the Kazakh steppe only during the early nineteenth century. Between 1822 and 1848, the three main Kazakh leaders (the Khans) of the minor, middle and major horde were suspended. A number of Russian forts were built to control the conquered territories. Russian settlers were provided with land, reducing the area available for Nomadic tribes in the Kazakh steppe. Many of them were forced to adopt sedentary lifestyles. As a result, in the various regions, between 5 and 15 percent of the population were immigrants. This Russian colonization was accompanied by many conflicts between the 1820s and 1840s, during which the Slavic settlements were often attacked. Russian troops only succeeded in ending this series of rebellions in 1846.

If we consider the numeracy of Kazakhs, it was quite remarkable (Figure 2.3). During the early nineteenth century, Kazakhs were actually more numerate than were Russians. However, Russia experienced a human capital revolution during the nineteenth century, and the colonized Kazakhs could not keep pace. Still, numeracy was higher than that of the more urbanized Central Asians in what later became Kyrgyzstan, for example.

What could be the reasons for this remarkable early numeracy level? The settler share can most likely explain part of this, although Russians were a minority in the Kazakh

steppe.[10] Another factor could be the relatively good nutritional situation in Kazakhstan. Protein malnutrition that plagued many other populations living in more densely populated settlements was absent in Kazakhstan. Additionally, in later stages of the process of Russian human capital development, Russian settlers of the 1870s and 1880s might have stimulated so-called contact learning (Prayon and Baten 2013). As the Kazakhs observed that Russians were successful with higher investment in human capital, the Kazakhs tended to adopt this strategy as well.

While the northern steppe only had population densities of about one to two persons per square kilometer, the southern part of Central Asia was more densely populated; its urbanization rate was as high as 15-20 percent during the late nineteenth century. This was the region of the old Silk Road, which had connected China with the Middle East and Europe since ancient times. Famous urban centers such as Samarkand had a remarkably developed merchant culture. Politically, the region had experienced many different rulers during the early modern period such as Mongols, Persians and Arabs. Soon after its cities had been conquered and sometimes destroyed, the income of merchant trade and intensive irrigated agriculture allowed reconstructing them once again. The Russian Empire invaded the Khanates of Kokand, Bukhara and Shiva during the 1860s, i.e., much later than it invaded the northern steppe. One motivation was to prevent the British colonial Empire, which had captured Afghanistan, from further expansion northward. In addition, the intensive cotton agriculture was attractive even more during the 1860s when the U.S. civil war led to the cotton famine that also affected the textile factories of Saint Petersburg and Moscow. In contrast to Kazakhstan, military resistance was more limited in the Silk Road region, similar to the northern steppe; however, some regions lost considerably in numeracy relative to Russia (Figure 2.3). The later region of Uzbekistan with its capital Samarkand was the most

[10] Even if migrant selectivity might have been positive, the effect could not be very large.

numerate of the whole region and better educated than Russian or Kazakh regions. However, even before the Russian conquest, numeracy stagnated. During the colonization and accompanying military destruction in the 1860s, numeracy fell dramatically. After modest recovery, the famous center region of the Silk Road was only 75 percent numerate in the 1880s, almost 20 percent lower than was Russia.[11]

In Algeria, numeracy was also quite high initially and stagnated on a relatively high level (Baten and Ghanem 2014). In contemporary travel reports of the mid-nineteenth century, the indigenous farmer population is described as unusually industrious and hard-working (Deutsches Staats-Wörterbuch 1857). The military conflicts between the French and the indigenous Arabs and Berbers were heavy and long; only after the mid-nineteenth century was Algeria really a French colony. Algeria was – apart from twentieth century Israel– the country most heavily settled by Europeans in the Middle East. During the late nineteenth and early twentieth century, the European share was almost a fifth of the population. The French government aimed at making Algeria an assimilated part of France, and this included substantial educational investments especially after 1900 (Figure 2.4). The indigenous cultural and religious resistance heavily opposed this tendency, but in contrast to the other colonized countries path in Central Asia and the Caucasus, Algeria kept its individual skills and a relatively human-capital-intensive agriculture.

In summary, we perceive three types of fundamental change: the Tanzimat reforms that opened many economies to European competition (and deindustrialization); the infant-industry strategy of Mohammed Ali in Egypt; and the direct colonization, which led to a relative decline in human capital in the Silk Road region and stagnation on a high level in Algeria.

[11] This was a substantial relative decline of human capital during and after colonization. In the later Kyrgyzstan region, development was similar (but from a lower initial value), whereas Turkmenistan had a surprisingly low level during the 1830s and 1840s.

2.6 Why did the Middle East deindustrialize during the nineteenth century?

Pamuk and Williamson (2011) note that during the eighteenth century, the Ottoman Empire was completely self-sufficient in textile production, which represented a large share of traded industrial goods. There were even small exports of carpets, silk and textiles. The share of the textile market that would be covered by domestic producers in the Ottoman Empire was still close to 100 percent in 1820; however, between then and 1910, it fell to less than 20 percent (Pamuk and Williamson 2011).

Pamuk and Williamson (2011) offer a trade-based interpretation of the process during which the Middle East deindustrialized. They argue that not only were imported British textiles during the nineteenth century outperforming many local producers, but another important point was the improving terms of trade of cash crops. Raw cotton prices increased substantially, for example. This change in terms of trade tempted the Middle East to specialize in this area of production. When the terms of trade for these goods declined again during the 1930s, there already was a high degree of path-dependence, which kept Middle Eastern economies in the cash-crop specialization. One could imagine that deindustrialization and concentration on agriculture discourages the development of skills.[12]

Other scholars searched for institutional factors that might have weakened the Middle Eastern economies, leaving them less competitive. Kuran (2011), for example, argued that institutions of Islamic law that were appropriate for early periods tended to become handicaps for growth during the nineteenth century. He criticized the stability of (1) inheritance laws because they did not allow capital accumulation, (2) the lack of legal frameworks for capital firms and (3) the religious trusts called waqfs, which locked capital resources into relatively inflexible institutions. Kuran was convinced that it was not

[12] We would argue that this is the case if no exogenous motivation for human capital investment exists. However, the cases of Denmark, New Zealand and the early history of the United States suggest otherwise; skill-intensive agriculture certainly was an option to develop high income even before later industrialization took place in some of these countries.

colonialism or religious attitudes per se that was growth retarding, but the excessive stability of these law concepts. Another institutional interpretation was given by Rubin (2011), who also criticized the view that Islam per se tended to generate less growth-conducive institutional design. For example, if interest constraints are considered, both the Christian Church and Islam aimed at restricting interest during the Middle Ages. This is an obvious example of an institution that limits capitalist development by constraining credit. In the early phase, Islamic bankers and merchants were actually more successful than Christian ones in circumventing this religious constraint (Rubin 2011). For example, Rubin reports about the Mukhatara institution known in Medina during the eighth century. One person bought a good for a certain price, but the other one bought it back immediately for a higher price to be paid later. However, later on, the development of credit institutions that circumvented religions constraints was more rapid in Christian Europe. Rubin argues that this was caused by the need of rulers to be legitimized by religious leaders. This factor became more important in the Islamic sphere. During the early period of Christianity, the first followers of this religion lived under Roman rule. Christian religious leaders developed doctrines that implied separated religious and governmental power. This was comparable to Jesus' insistence on giving Caesar what belonged to him and God what was his. In contrast, during the early years of the Muslim religion, political power was weak and the first Caliphs gained their legitimization from being relatives of Mohammed. The leaders that later followed them felt legitimized by obeying religious rules very strictly. Although Christian popes and bishops also tried to influence politics—and kings used religion as legitimization—in Christianity, there was always more tension and sometimes competition between religious and political leaders (Rubin 2011).

Another factor that limited industrial competitiveness in the Middle East might have been the interaction between economic segregation and human capital development. Some minorities were considered to be predetermined for occupations in finance and trade in the Middle East; therefore, talented individuals of the majority might have had fewer incentives to develop trade-related skills. This limited human capital development. An important social factor in the economic development of Middle Eastern Economies was the minorities of Greeks, Armenians, Jews and Christian Arabs. They were active in the trade sector and played a role in finance, export-oriented agriculture and the modest beginnings of modern industry. European merchants and colonial bureaucrats cooperated with them and partly protected them because these minority members were often more interested in learning foreign languages and developing technical skills.[13] In Turkey, Greeks, Armenians and Jews were most important. In particular, the Galata bankers dominated Turkish financial development during the early twentieth century. Armenians and Greeks were also active in internal trade, industry, crafts and the professions. In Iran, minorities played a smaller role, except for Jews, who were active in both Iranian industry and trade. In Egypt, Copts held a remarkable share of the land, and they worked in the professions as well as government services. In Lebanon, Christians began to dominate foreign trade and the silk industry beginning in the early nineteenth century. This group also took over the traditional Jewish role in Syria in finance and industry. The importance of these minorities was largest in the period at the beginning of the twentieth century. After that, the growing national aspirations of the majorities had the effect of more and more majority members starting to cover positions previously held by the minorities. However, the motivation of talented Arab,

[13] In addition, the Tanzimat reforms from the 1830s removed many of the constraints under which the minorities ("millets") had been suffering for centuries. They also received support from people of the same religion who lived in Europe and America.

Iranian and Turkish majorities to invest in trading skills developed late partly because the minorities had a low social reputation in their eyes and imitating them was not desirable.

2.7 Living Standards

Pamuk (2006) found that GDP development was slow in the Middle East. He estimated that GDP grew from only $611 per capita in 1820 (measured in constant 1990 dollars) to $1,023 in 1913, covering Turkey, Egypt, Arabia and Iran. As a percentage of the U.S./Western Europe national income value, this meant falling back from 49 to 25 percent. The gulf region developed even more slowly than did the core region of the Ottoman Empire, with Lebanon being the richest country in 1913.

Does this lag in production capacity imply that the overall standard of living was lower? Özmucur and Pamuk (2002) pointed to the fact that real wages were actually equal or greater in the large Middle Eastern cities. As real wages reflect urban unskilled and skilled craftsmen`s welfare, it seems that the richer strata such as merchants and professionals were lagging compared to Europe.

Another approach to analyzing welfare is to look at human stature. This reflects health and nutritional quality, which are important components of the standards of living of a population. This is especially informative in data-scarce regions such as the Middle East and North Africa. For the Middle East, some recent estimates have been based on anthropological measurements; a number of famous anthropologists travelled in the Middle East in the eighteenth and nineteenth century, systematically measuring many individuals.[14]

[14] The advantage of these samples is that there is no social selectivity in height measurement, although there could be a regional selectivity issue. Stegl and Baten (2009) already accounted for this potential distortion; it seems not to play a large role.

The height measurements are organized by birth cohort,[15] and a sufficient number of observations allow assessment of the period from the mid-nineteenth century onward. Stegl and Baten (2009) choose a sample of eight Middle Eastern countries where height data were available for the studied period (Figure 2.5). Turkey, Iraq, Iran, Egypt, Syria, Lebanon, Palestine/Israel and Yemen are included. They compare the average heights of these countries with a sample of central and southern European countries. Stegl and Baten showed that people born between 1850 and 1870 in Middle Eastern countries enjoyed on average a favorable nutrition compared to Europe. However, in 1880, the average heights of Middle Eastern people decreased suddenly. European human stature began to exceed it, although with only a small difference for three generations. This difference increased over time, reaching more than 7 centimeters for the generation born in 1980. Compared with the world height average, this initial lead vanished during the twentieth century (Figure 2.6).

There were also strong differences between regions within countries; these regional differences shed light on the explanation of the height trend. In Iraq, for example, the average height differed between desert inhabitants and the other inhabitants (both urban and rural). The desert Bedouins were on average 0.85 centimeters taller than were other Iraqis. The reason behind this difference is the low population density in the desert, where more people could benefit from the meat and milk of the stock breeding in which the desert tribesmen engaged.

In Turkey during the late nineteenth century, Stegl and Baten (2009) find the shortest population in the western coastal areas, which are now the richest regions in the country, while the tallest people lived in central Anatolia. A likely explanation is again the low population density in central Anatolia. The population specialized on cattle farming. For

[15] All heights are organized by birth cohort, because the strongest influence on final adult stature occurs during the years after birth.

example, Issawi (1980) analyzed tax returns and reported that animal husbandry was most important in the relatively dry inland regions. In this central area, low population density and a partly nomadic lifestyle allowed protein-rich nutrition.

Egypt is a dry country in general; the agriculture depends mainly on Nile water. Only in the northern coastal region is the rainfall level slightly elevated. The inhabitants of this region had the advantage of obtaining enough rain for their crops, and their height values were greater than were those of other Egyptian areas. The desert inhabitants of Egypt also had a height advantage in comparison with the urban population. For neighboring Libya, Danubio et al. (2011) found that the heights of nomadic Tuareg born in the 1880s to 1900s were 3 cm greater than the heights of other Libyans; on average, they were even 8 cm taller than were Libyan oasis inhabitants.

In general, between 1850 and 1870, the inhabitants of the Middle East showed a high average stature according to nineteenth century standards (Figure 2.6). This good level first dropped in the 1880s. One potential immediate cause of the 1880s height drop might have been the cattle disease, which originated in Asia in the 1880s and then moved through the Middle East to the eastern part of Africa, which was severely hit in the 1890s.[16] However, there were additional underlying forces affecting the relative decline of Middle Eastern heights. During the nineteenth century, parts of the Middle Eastern population still benefitted from the so-called “proximity advantages” to animal husbandry. Bedouins and other inhabitants of the Middle East who lived close to goats, sheep and cattle could enjoy more protein from milk and meat. Not only rich people could buy this; poor tribesmen also obtained their share, especially of the less-popular parts of the animal. In contrast, Europe with its densely populated urban centers did not have good access to protein sources during

[16] In Iran, the decrease happened in 1880 as well. Gilbar (1986) assumes that, in Iran, the boom of crops agriculture such as cotton, opium and grain encouraged people to pay more attention to planting these crops and pushed them away from animal farming.

the mid-nineteenth century. In the twentieth century, the situation changed. Even perishable foodstuffs such as milk could now be transported, thanks to refrigeration transport technology. European inhabitants of large cities could provide their children with good nutrition, and urban populations became taller than rural ones. Europe also made strong and early progress in Public Health and medical development. Their GDP level was much higher than in the Middle East during the twentieth century; hence, they could afford good nutrition and health during this later period.

Summing up, the interesting and slightly astonishing fact of this section was that during the mid-nineteenth century, Middle Eastern populations did not necessarily suffer from poor nutrition, relative to Europeans. The fascination of European travelers and writers for the inhabitants of deserts might have originated partly in the special economic situation of nomads during this period. The strong relative decline during the twentieth century might have stimulated perception of severe injustice among these tribesmen, who still trained themselves in military activities.

2.8 The Middle East in the twentieth century

Issawi (1982) concluded that, for the period just before WWI, almost all powerful positions in Middle Eastern economies had been taken over by Europeans or minorities such as Armenians, Greeks, other Christian minorities and Jews. He interprets the following century as an attempt to reverse this development. Europeans and entrepreneurial minorities were forced or encouraged to leave, or sometimes killed (such as many Armenians in Turkey). The two world wars that devastated Europe allowed the Middle Eastern reaction to abolish privileges (such as immunities for European merchants) and to nationalize railways, banks, gas stations and other utilities. The ideology of the interwar and postwar years further

promoted government-owned mining and industries. However, even if nationalized industries might have been able to satisfy consumers with relatively simple products during the mid-twentieth century, this way of organizing industries tends to be weak in the quality of goods produced, and in the long run, new investments were missing. For example, countries such as Yemen lost their minority tradesmen (that might have developed into entrepreneurs later on), and the relatively low status of human capital development made it difficult to develop its own Yemenite entrepreneurial groups. Turkey was more successful in developing its own entrepreneurs, given that the status of education had always been higher and the Ataturk reforms placed particular emphasis on education. In addition, Turkey also benefited from the slightly more equal gender distribution of education after the Ataturk reforms.

In Turkey during the time of Mustafa Kemal Ataturk in the first half of the twentieth century, many reforms were initiated in different fields such as politics, economics and culture. Ataturk's reforms can be summarized mainly as abolishing the sultanate and afterwards the caliphate system in the country and converting the republic of Turkey into a secular state. That is, Turkey, although having a Muslim majority, changed from being an Islamic state to a laic country. Ghanem (2014) assessed whether separating the religion from the government had a positive influence on human capital in Turkey. The results confirm that the secular state of Turkey led to a clear increase in numeracy levels in the different Turkish regions. New schools were built and primary schooling became mandatory and free. In addition, Ataturk replaced religious education with a national education system. Turkey did not change to an atheist state; the freedom to worship and follow religions existed. However, the idea was to concentrate on Islam in the mosques and religious places; what mattered at school was science and education (Ghanem 2014)

After the Middle East had deindustrialized during the nineteenth century, the situation started to change during the twentieth century. Political movements in the Middle East not only demanded a political renaissance, but many of its leaders also saw the need for reindustrialization (Issawi 1982). The two World Wars also made clear that European imports of industrial goods were not automatically available. The exceptional situation during the wars also allowed experimentation with new production methods within the Middle Eastern countries, even if these were not yet competitive.

Already before WWI, some industries were growing again in Egypt and Turkey, for example. Soon after the breakdown of the Ottoman Empire, Turkey started to develop more-active industrial policies. Indirectly inspired by the Soviet Union, Turkey decided to set up two five-year plans during the 1930s, making clear that the state would play a strong role in this reindustrialization attempt. All Middle Eastern economies lacked entrepreneurs. As suggested by the ideologies of the time, the state was expected to fill the gap. In addition, socialist ideas were important in countries such as Syria, Iraq, Algeria, Afghanistan, Egypt, and obviously Central Asia, then a part of the Soviet Union.

One different approach to industrial development was taken in Palestine and later Israel. The Sykes–Picot Agreement in 1916 divided a part of the Middle Eastern region—which was previously part of the Ottoman Empire—between England (Palestine, Iraq, Transjordan) and France (Syria, Lebanon).The former Ottoman territory of Palestine became a British mandate in 1920. In 1922, the League of Nations decided that in this territory, a "national home" for Jews should be established, while still guaranteeing the civil and religious rights of all the inhabitants. Following this political decision (and reinforced by anti-Semitism in Germany and other countries during the interwar period), a strong immigration of Jews from different world regions resulted. Their population share rose from 9 percent in

1919 to 32 percent in 1947. Many Jews brought skills and entrepreneurial traditions. Given that the British Mandate aimed at restricting land purchases of previously Arab-owned land by Jewish immigrants, the Jewish population group was initially more urban and had a higher share in industrial occupations than did the Arab majority. This particular development in Palestine, which had terrible political and humanitarian consequences later on, resulted economically in one of the few growth miracles of the region. In addition, the structure of firms was determined much more by private entrepreneurs than by the government as in many other Middle Eastern economies.

Why were twentieth century firms in other countries so often run by the government? Three main reasons come to mind. We already mentioned above that entrepreneurial elites were often foreigners or minorities and that, in the view of Arab, Iranian and Turkish politicians, the influence of both groups was to be reduced during the twentieth century. The other two main reasons were the lack of human capital and skills and the peculiarities of oil production economies.

We first discuss the skills and human capital levels during the twentieth century. Basic numeracy was generally not very high during the nineteenth century and did not converge rapidly to neighboring European levels (Figure 2.4). Only during the early twentieth century can a strong improvement be noticed. This deficit in the educational component, numeracy, is equally visible in the other components of education, such as literacy. Issawi (1982) mentioned that, literacy was only 7 percent in Egypt in 1907 for example. The governments spent little public funds on education. The 1860/61 Ottoman budget on education was only 0.2 percent of total expenditure. In Algeria, it was slightly higher at approximately 2 percent (1890-1914). Even during the early twentieth century, the number of school years was quite low (except in Israel, where it was substantially higher [Barro and

Lee 2013]). The most extreme was Yemen, where children received almost no schooling (Figure 2.7). In the Gulf States, the situation was slightly better.

Similar statements could be made about secondary and tertiary schooling. Such a low level of numeracy and school education made it very difficult to develop a class of entrepreneurs because this type of occupation requires substantial abilities to work with numbers. The function of entrepreneurs was, therefore, taken over by the state.

Another reason was the amount of oil revenues. If the Middle Eastern economies reinvested the government share of oil income, they often did this in the form of state-owned companies. In 1908, oil was discovered in the Middle East. This discovery completely changed the landscape of its economies. Oil had always been used in small amounts, for example, in the form of seepage for rubbing of camel sores. In two places in Iraq, crude oil was already extracted in the 1870s with quite primitive methods. However, real development started in the 1900s. The Iranian government decided to give a concession to a British company. Other countries also gave concessions to European and American firms, ultimately resulting in an oligopoly structure of less than ten large oil-mining firms that has persisted until today with varying actors. In Iran, the British monopoly concession was soon debated with great dissatisfaction among the Iranian population. However, Reza Shah again signed in 1933 an unpopular agreement under British pressure. The question about the nationalization of its oil reserves became one of the key issues in the social and political conflicts in Iran during the 1940s and 1950s.

During the pre-WWII period, most oil extraction took place in Iran and on a much smaller scale in Egypt. Only during the 1940s did Iraq also become a major exporter. To a much smaller extent, Bahrain and other Middle Eastern Countries also increased exports. Up to 1940, Middle Eastern and North African oil production was still below 5 percent of world

production. However, it then exploded to 26 percent in 1960, reaching a maximum of 42 percent in 1975. Initially, the Middle Eastern countries did not receive much of this new wealth. However, between 1950 and 1975, direct payments from the petroleum companies to the governments rose from $240 million to $81 billion (and to $163 billion in 1979). The renegotiation of contracts with the petroleum companies and the formation of the OPEC in 1960 resulted in dramatic change. OPEC's cartel policy during the Arab-Israel conflict of 1973 and later in the 1970s generated a flood of revenues for the oil states Iran, Iraq, Kuwait, Saudi Arabia, Qatar, United Arab Emirates, Egypt, Libya, Algeria, Bahrain and Oman (Oman, and also Syria, Israel and Turkey had quite small revenues).

What was the effect of oil production on the economies? Issawi (1982) concludes after carefully weighing many pros and cons that the initial period of the 1950s and 1960s was quite beneficial. In particular, some of the least-developed countries receiving oil revenues served as a stimulus for their economies. In general, only a small part of the population worked in oil production (normally less than 2 percent), but in the Gulf States, it could be up to one-half. Many persons who left oil companies also created their own firms. Training on the job allowed developing the necessary entrepreneurial skills and the "spirit".

However, the 1970s oil price increase and production expansion brought an enormous amount of wealth that resulted in mixed blessings for at least three reasons: (1) Some of the classical 'Curse of Resources' phenomena occurred. Issawi (1982) speculated that it was difficult for the Middle Eastern people to find agreement on how to distribute the wealth, partly because it was subjectively not "earned" by the individual population groups in the oil countries.[17] (2) In addition, the view that "anything could be imported" was shared by many Arabs and Iranians, which was poison for reindustrialization efforts. (3) The high

[17] In contrast to industry, for example, where profits went to entrepreneurs and wages to workers.

expectations of income generated by the seemingly inexhaustible stream of revenues became unrealistic. Rising inequality between those who benefited and those who perceived themselves as losers created so much dissatisfaction that it could even lead to civil war as in the case of Algeria, or at least extremist political attitudes in other countries.

What could the government do about all this? The only feasible strategy was to try to reinvest much of the oil revenues into firms that would generate income after oil income ended. The owner of those firms was often the state. A major problem was, however, that the state-owned firms tended to be highly inefficient. A government bureaucrat was not necessarily the ideal person to maximize productivity and to reduce costs. When problems of competitiveness appeared, managers demanded import protectionism and monopolies, rather than improving the production side and looking for new markets and new technologies. Only in recent decades have these issues have been partly improved and structural reforms initiated. However, perceived injustice in some of the countries was already widespread. In addition, possibilities for democratic participation and improving the situation were limited, which reinforced dissatisfaction. Finally, some of the industrial countries performed interventions to secure oil resources for themselves in recent decades. All these factors resulted in a series of wars and internal conflicts that have had terrible consequences for the Middle East until even today.

To what degree are these developments of the twentieth century reflected in GDP trends and living standards (Figure 2.8)? If we consider the development of GDP per capita in the Middle East between the 1950s and today, we can rely on some informative statistics which are of course not beyond doubt, especially not for the early periods. Some of the governments also had a strong preference for window-dressing of indicator variables. However, in general, we can gain some insight from looking at GDP as an indicator of

productive capacity. Given that we have a large number of countries in the Middle East, we reduced the set of the countries we examine in detail to 13 because, for example, some of the Gulf countries such as the United Arab Emirates, Kuwait and Bahrain developed similarly to Qatar.

If we look first at the six countries which represent the center and the north (Lebanon, Turkey, Israel, Iran, Afghanistan and Iraq), we see that Israel had a relatively favorable development. Given the relatively good educational status of the Israeli population, this is not astonishing—even though the country did not benefit from oil resources. This is quite different in the cases of Iran and Iraq, both of which had a substantial GDP increase from the 1950s to the 1970s. The oil price explosion and expansion of oil production was clearly a driver here. Especially during the early 1970s, oil prices were at an enormously high level. Later on, Iran had some modest decline during the intensive war of 1980-88 with Iraq. In Iraq, in contrast, we have a substantial decline of GDP per capita in the 1990s following the Kuwait crises and the two Gulf wars with the United States. GDP in Iraq has most likely experienced the strongest decline of any of the larger countries of the Middle East. The poorest country in this region is Afghanistan, which always had a very low development level; also, the country's educational values were usually quite low. Interestingly, the second highest level of GDP was initially reached by Lebanon. Despite not having oil reserves, Lebanon, as the banking center of the Middle East and one of the trading centers, had a high national income in the 1950s, even without oil.

Moving to the Arabian and Gulf economies, we see again a strong difference in the early period between countries with and without oil. For example, Yemen was very poor, whereas the small oil economies in the Gulf like Qatar started with a quite high GDP per capita. The small population of Qatar combined with very large oil reserves resulted in an

enormously high GDP per capita. Saudi Arabia and Oman benefited from the oil increase. In the 1990s to 2010s period, the three richer countries of this world region had relatively similar GDP values. Finally, we consider three countries of the North African area.[18] We see that Libya shared the strong increase in oil revenues between the 1950s and 1970s. When oil was not a driving force anymore, Libya experienced a decline in GDP per capita up to the 1990s and stagnated since then. There was a gradual increase in Egypt and Algeria. Even during the period of the Algerian civil war (1991-2001), the GDP level did not plummet catastrophically because it was offset by other factors.

Because GDP per capita is strongly dependent on oil revenues and availability, it is important to consider life expectancy as an additional welfare indicator for this period is (Figure 2.9). If we compare trends in life expectancy for the same countries, we first observe a steady increase in all the countries, which is mainly driven by worldwide medical progress. Everywhere in the world, we had a strong increase in life expectancy during this period. However, looking a bit more closely, we see some interesting differences in life expectancy. First, slightly different from GDP development, Lebanon develops much better. It starts again at the second highest level directly behind Israel, but in contrast to GDP developments, it stays at a high level, even during the civil wars of the later twentieth century (1975-1976, and sporadically thereafter).

The other countries typically developed from values between 35 and 45 years of life expectancy in the 1950s to values of approximately 65 in the 2000s, but some countries deviate from this pattern. The most obvious deviation is Afghanistan, which started at a very low level of approximately 37 years of life expectancy. During its history of civil war and underdevelopment, there was only very modest progress in Afghanistan. Modern

[18] Again we omit Tunisia and Morocco because the development was quite similar to the one of Algeria

technology was not able to diffuse in this country; even in the 2000s, we still only have values of approximately 45 years of life expectancy. In contrast, in Iran, which started even slightly lower than Afghanistan according to these estimates, we see substantial progress in the 1950s to 1970s. Even during the Iran-Iraq war, which many observers compared to WWI in terms of violence and number of victims, Iran and Iraq did not experience a decrease in life expectancy.[19]In Iran, parallel developments of improving health and nutrition most likely counter-balanced the war effects, although the value of 65 is slightly below what most other Middle Eastern countries achieved during this period. In the Gulf region, Qatar was always slightly ahead of Oman and Saudi Arabia. Unfortunately, we do not have estimates for Yemen during this period. In North Africa, we see a somewhat parallel development in the three countries under study up to the 1970s, after which Egypt had slightly less progress.

2.9 Conclusion

The economic history of the Middle East, North Africa, and Central Asia offers a great amount of variety. Although urban cultures may have lost the world-leading role they had in the high Middle Ages, the urban centers of the region continue to be highly important. Istanbul was the largest city in Europe until 1750. At the other extreme, nomadic economies of the deserts and half deserts display some surprising characteristics. For example, nutritional status was substantially higher in the Middle East than in Europe during the mid-nineteenth century. This can be partly explained by the good access of nomadic people to protein. Only after the cattle plague period of the 1880s and 1890s did health and nutrition development become worse than in Europe. During the nineteenth century, the Middle East became the object of colonialist influences from Western European powers after the

[19] We assume that there is no misreporting

Ottoman Empire gradually decreased in influence and became the 'Sick Man of Europe'. In the northeast of the Islamic world, the Russian Empire expanded to include the previous Khanates of Bukhara, Fergana, and other Islamic central Asian territories. Cash-crop economies developed, such as cotton in Egypt and what is today Kyrgyzstan.

During the twentieth century, the first substantial oil revenues were earned in Iran and other countries. The economic history of the Middle East, North Africa, and Central Asia was also a struggle with the 'Curse of Resources' both during the nineteenth and the twentieth centuries. Pamuk and Williamson (2011) demonstrated that, ironically, favorable development of export prices for Middle Eastern cash crops (such as cotton) lured the region into deindustrialization. Positive price signals had negative long-run consequences.

Another reason why Middle Eastern economies found it difficult to compete with European industrial goods was that human capital and skills to compete with European producers were lacking. The Ottoman Empire had invested almost no public funds in schooling during the mid-nineteenth century; nor did families or religious schools teach abilities useful for industrial development. In addition, low governmental abilities to tax were a factor, as well as institutional developments that interacted with traditional laws and rules of the world region.

The 'Curse of Resources', of oil in particular, also had the effect that many revenues were reinvested in state-owned firms that became inefficient burdens on the economies. A number of studies have discussed whether oil and other natural resources often result in specific types of political economies in which small groups obtain great wealth while a large part of the population considers their share of income and political participation to be insufficient.

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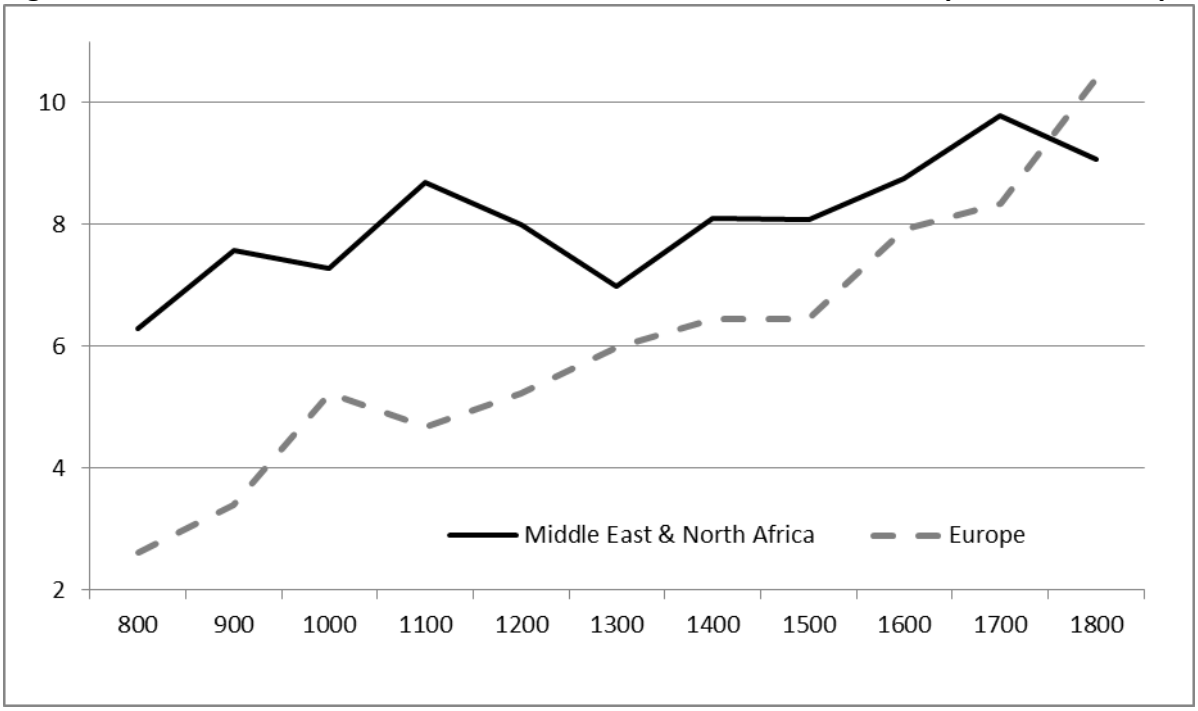
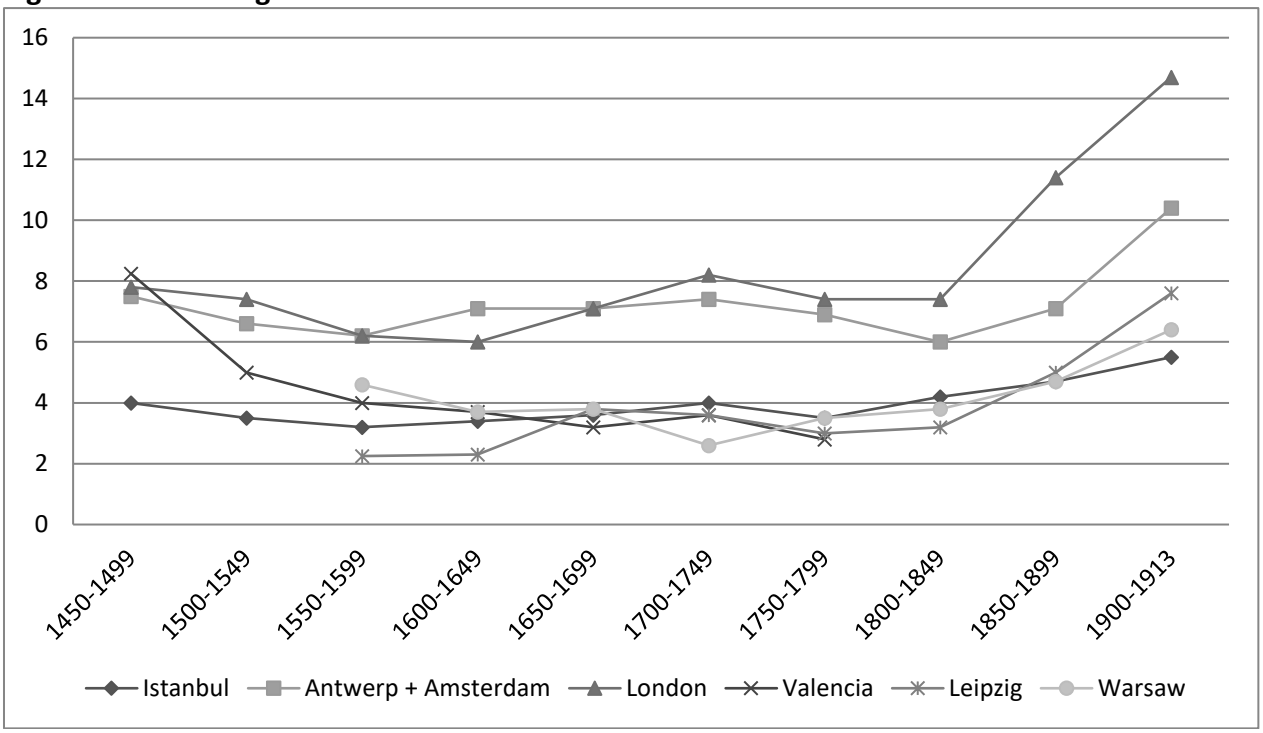
2.11 Figures

Figure 2.1: Urbanization rates in the Middle East and North Africa, compared with Europe



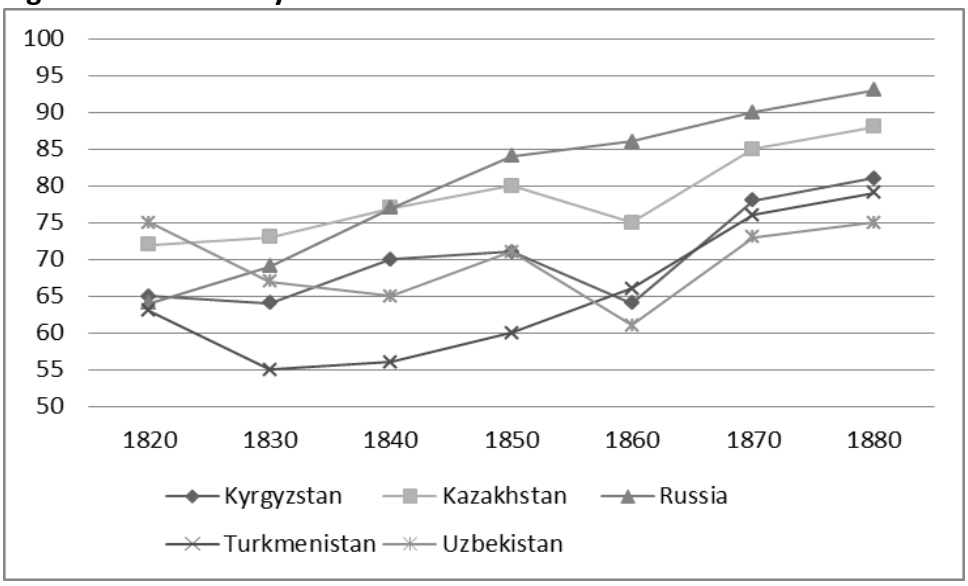
Source: Bosker, Buringh and Van Zanden 2013. Note: The geographic definition is used, which categorizes the Byzantine Empire as a Middle Eastern economy even if it was Christian, and Sicily and Muslim Iberia as European, even if it was Muslim during the early part. However, given that their population sizes were similar, and given that there was no religion-specific data available, the authors kept it this way. Excluded are Russia, the Caucasus, Scandinavia, Iran and Afghanistan. Only cities with population greater than 10,000 are included.

Figure 2.2: Real wages of unskilled urban workers



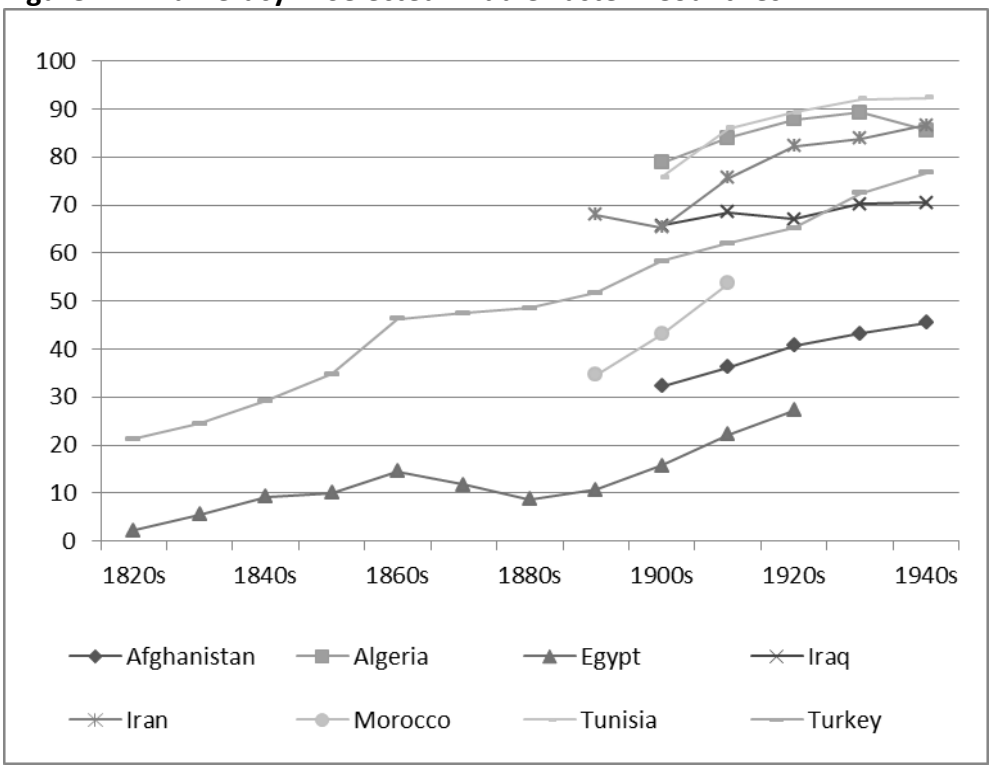
Source: Özmucur and Pamuk (2002). For European cities, they used Robert Allen's estimates.
Notes: Real Wage of Unskilled Construction Workers in European Cities, 1450-1913 (wages [in grams silver] divided by CPI [in grams silver]).

Figure 2.3: Numeracy in Central Asia



Source: Prayon and Baten (2013).

Figure 2.4: Numeracy in Selected Middle Eastern Countries



Source: Prayon and Baten (2013).

Figure 2.5: Height in the countries of the Middle East

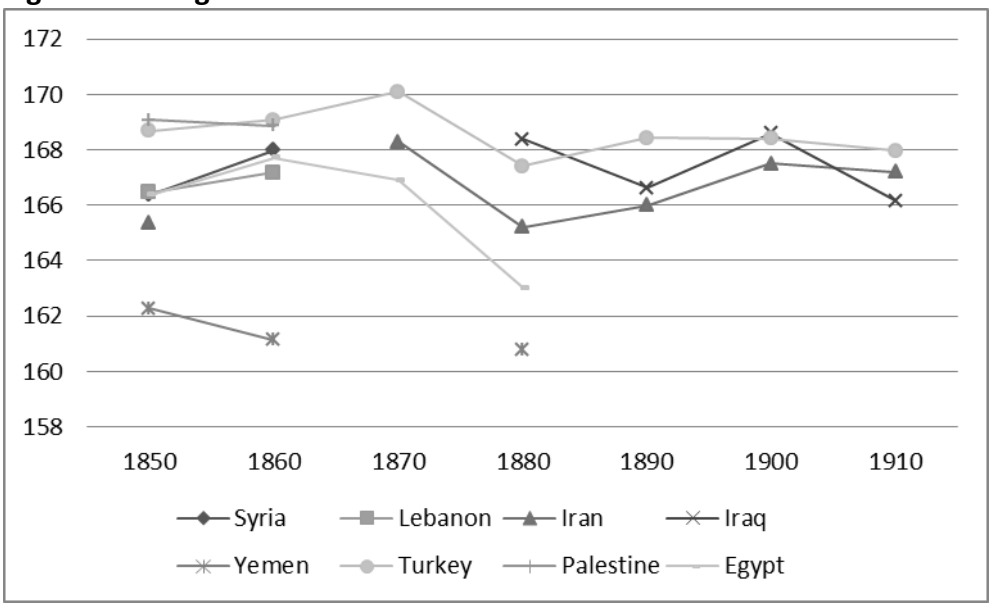
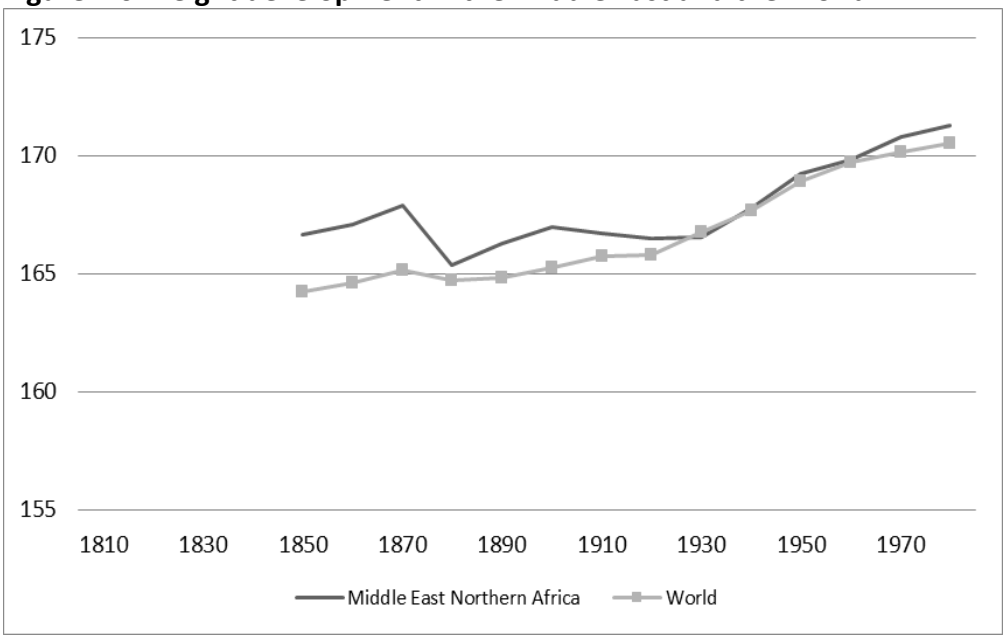
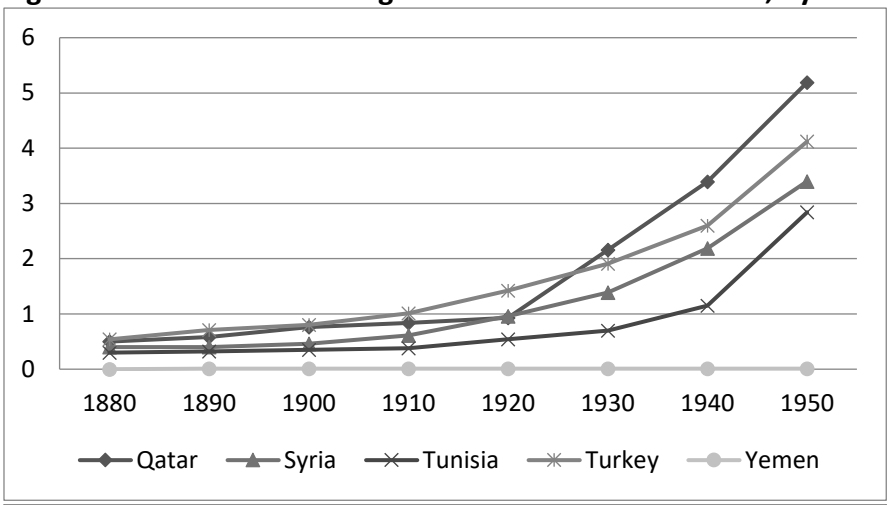


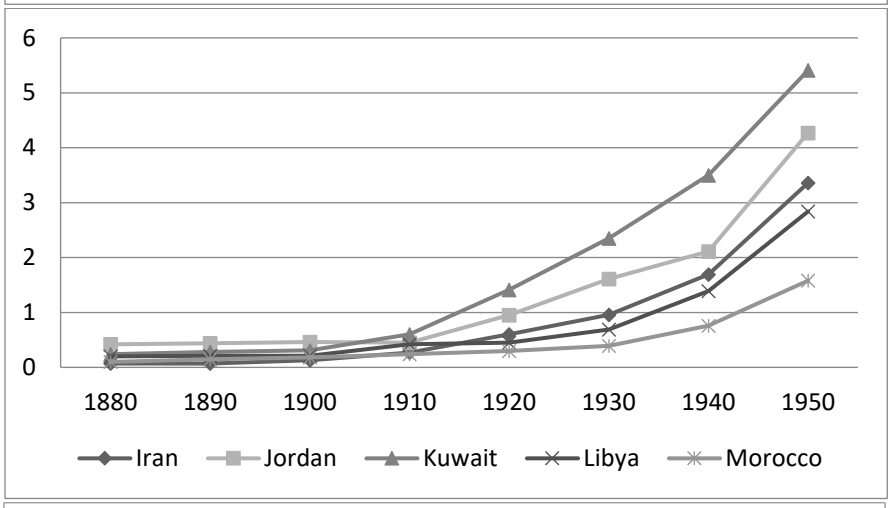
Figure 2.6: Height development in the Middle East and the World

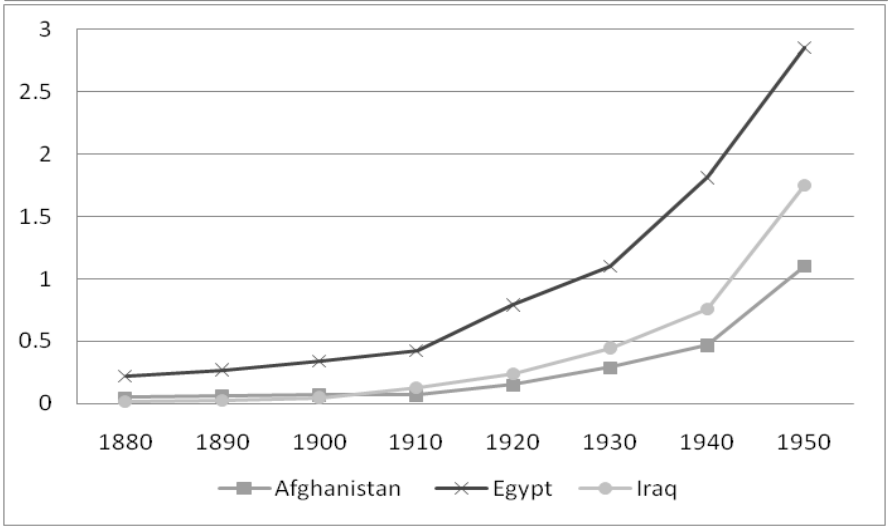


Note: See Baten and Blum (2012) for interpolation strategies (Missing values have been interpolated to avoid artificial "jumps" caused by data availability).

Figure 2.7: Years of Schooling in Middle Eastern countries, by birth decade

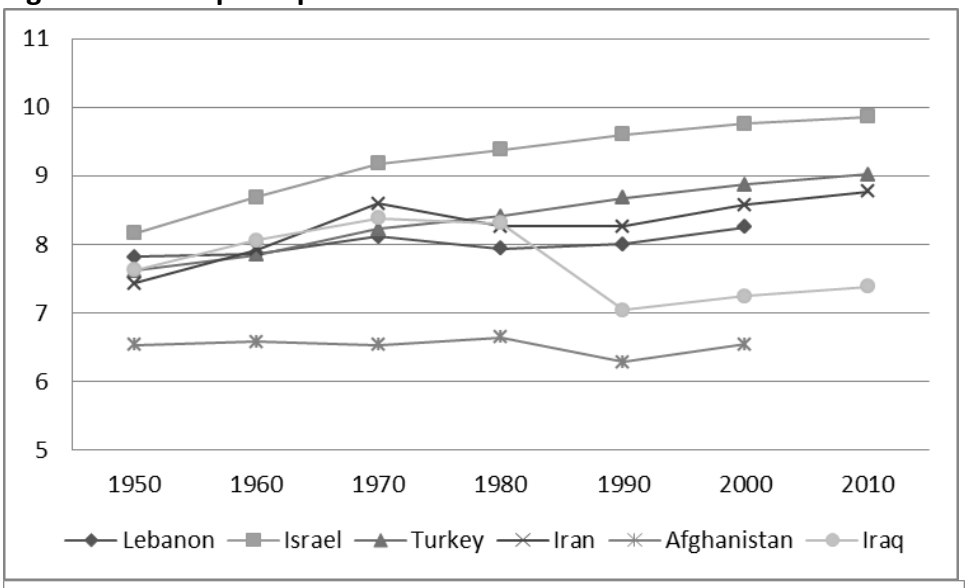


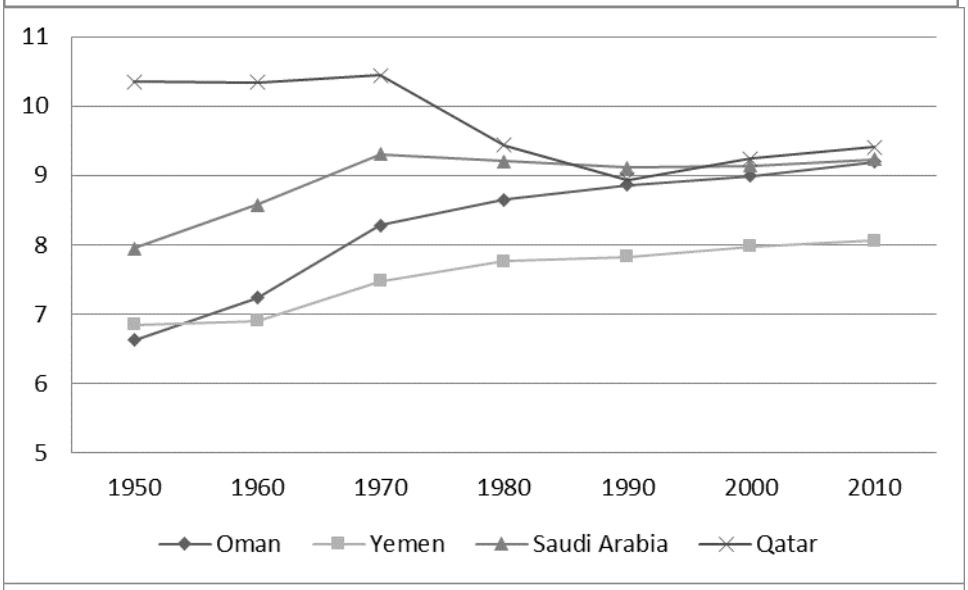




Source: Calculated from the Barro-Lee database (http://www.barrolee.com/) but arranging all data by primary school decade (i.e., the decade in which a cohort was approximately age 10). This assumes no strong survivor-bias distortion and no strong adults schooling (See Baten and Ghanem 2014).

Figure 2.8: GDP per capita in selected countries of the Middle East





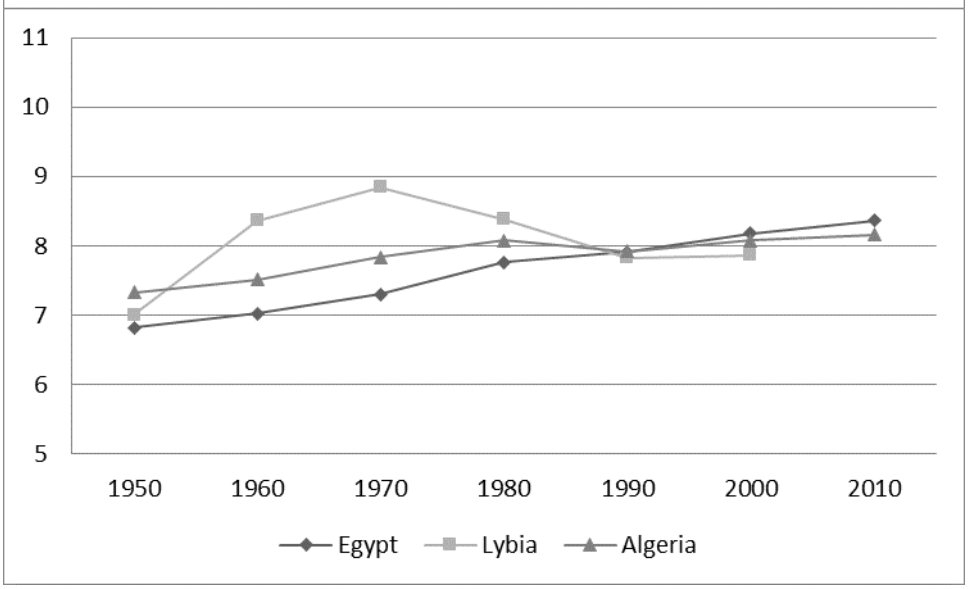
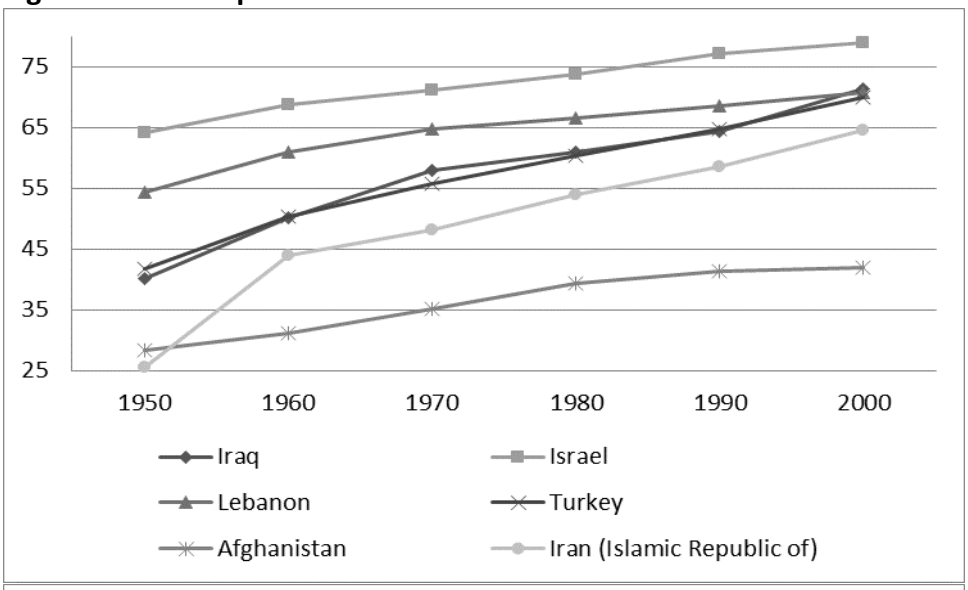
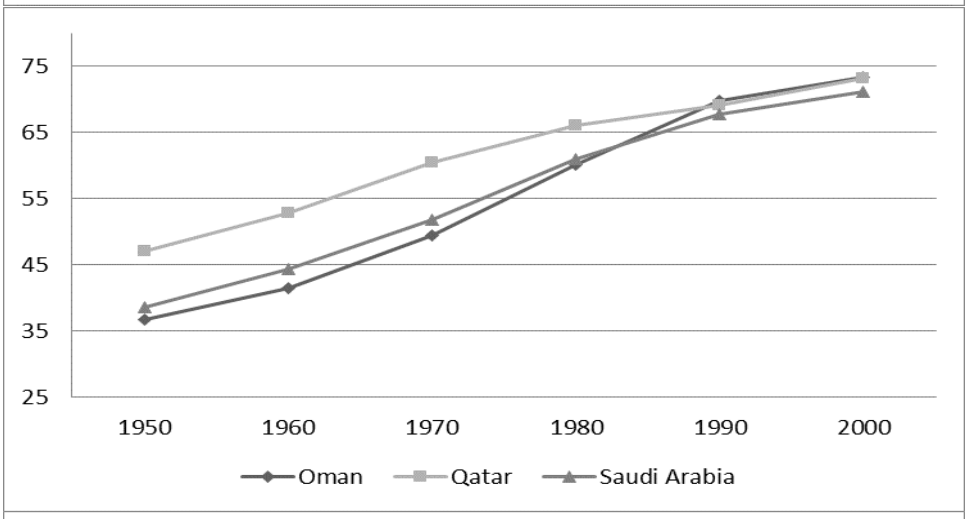
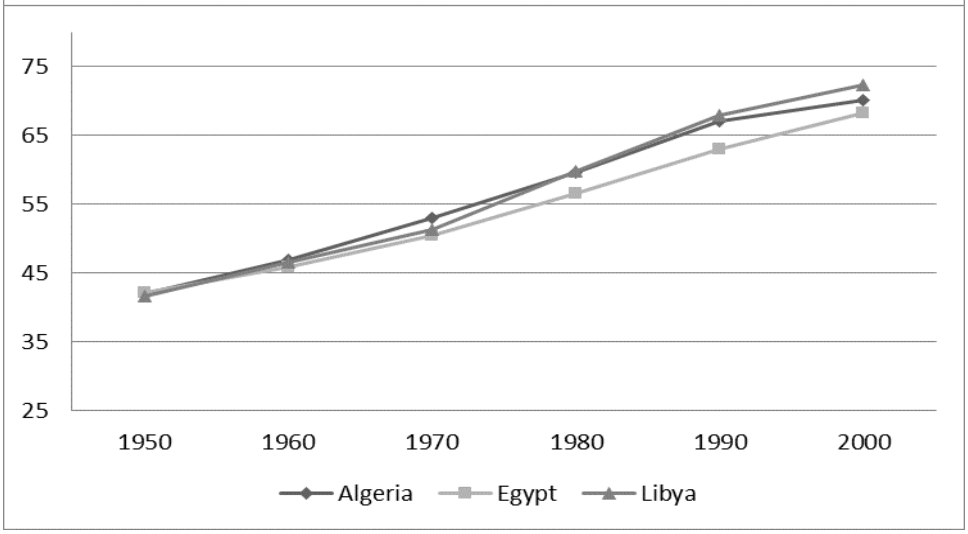


Figure 2.9: Life expectancies in selected countries of the Middle East







3. Was there a 'Curse of Resources'? Oil Production and Human Capital Investments in the Middle East and South Asia 1880-1989

Abstract

The stylized fact of the "Curse of Resources" suggests that countries with a high share of primary mining exports do not develop well. Applied to the countries of the Middle East and South Asia this might imply a much more modest development once oil had become an economic pillar in some economies in this world region. On the other hand, Issawi (1982) argued that prior to the oil price boom of the early 1970s, resources were rather a blessing for the previously relatively poor economies that became raw material exporters. This study inquires whether this tendency can be observed in the human capital investment histories of the Middle East and South Asia. Both regions had similar human capital levels at the beginning, but rather different resource endowments. We compare the tendencies of numeracy and years of schooling in a large panel data set of countries since the 1880s in order to assess whether there was a divergent behaviour between countries and over time.

This chapter is developed jointly with Jörg Baten. The concept of this paper and the writing were 20% on my behalf, to 80% on behalf of Jörg Baten.

3.1 Introduction

The theory of the "Curse of Resources" suggests that countries with a high share of primary mining exports face surprisingly greater problems of development, whereas resource-poor economies do not have these problems – with some notable exceptions (for example Botswana). Sachs and Warner (1995) assessed the correlation between the occurrence of large amounts of resources and problems to develop. It turned out that large amounts of oil and other resources typically led to specific types of political economies, in which a small percentage of the population obtained great wealth and the majority considered their share of income and political participation to be insufficient. A large number of studies followed their seminal study (for an overview see Van der Ploeg, 2011). However, other studies did not confirm this "curse of resources", if they used other econometric methods. For example, if the resource dependence was instrumented with subsoil resource wealth, it was not significantly affecting GDP growth, and if subsoil resource wealth or abundance were included as an independent variable in an OLS regression, this even had a significantly positive effect on growth (see Brunnschweiler and Bulte 2009). If resource dependence was instrumented with reserves that can be mined, there is no significant effect of either curse or blessing. Especially large and suddenly occurring revenues can be a mixed blessing; oil is one of the most famous examples. Therefore, we primarily focus on oil production in this study.

Clearly, a lot of other important developments took place in the Middle East and South Asia during the period since the 1880s. Hence, a second hypothesis that we want to test is whether colonialism had a destructive effect on schooling growth. While South Asia was colonized early on, the Middle East became subject to colonialist influences from Western European powers after the Ottoman Empire gradually decreased in influence. For

example, France colonized Algeria already in 1830, Egypt became a British protectorate in 1882, Syria, Lebanon, Palestine and Iraq became colonies or protectorates in 1920. We include both world regions in this study, because they initially had similar human capital levels. This enables us to assess the influence of colonialism on human capital trends.

In the discussion of colonialism effects, many historical narratives stress not only the obvious loss of freedom and dignity for the colonized, but also the negative effects on schooling (Lindert 2004). In many cases, colonial powers were not interested in investments in education – especially if they made the experience that as a result of better education, the colonized were more skilled and able to organize themselves in initiating riots, just as the British observed in India (Issawi 1982). On the other hand, some economists of the extreme left and the right side of the political spectrum were arguing that sometimes colonialism brought a general modernization to previously less developed economies. Furthermore, they stress, that this also had positive effects on education, even if this might not always have been intended by governments (Ferguson 2011, Sender and Smith 1986).

However, the implications of these theories have not been tested for a large panel of countries over the long run. This is even more surprising given that the economic history of the Middle East and South Asia offers a great amount of variety in development experiences. The lack of research in this world region for the early period was probably caused by the lack of evidence of early schooling investments. The evidence used for this research is primarily based on years of schooling taken from different censuses for most Middle Eastern and South Asian countries.

In sum, we create a new dataset of human capital development during the 1850s-1990s period to test the influence of oil production and colonialism on long-run human capital formation. The methodological idea is primarily to use a panel of changes between

years of schooling by first decade of life for 20 countries of the Middle East and South Asia between the 1880s and the 1980s. We use first decades of life, as most primary schooling is taking place in the first years of life. The overall amount of schooling in the countries under study is mostly small during the whole period. Hence, secondary and tertiary education do not play a large role.

The next section provides a short literature overview on the human capital history of the Middle East and South Asia and explains how we trace the growth of primary schooling. In section 3.3, we discuss potential explanatory variables and available data sources. Section 3.4 describes the OLS and instrumental variable test regression results of our empirical study. Section 3.5 concludes.

3.2 Historical Background: Human capital in the Middle East and South Asia

During the early medieval period, the technology of the Middle East was superior to that of Europe (Chaney 2016, Ghanem and Baten 2016). Knowledge was flowing from the former to the latter. South Asia had also developed strong industrial skills. However, during the 19th and 20th centuries the Middle East was growing less than European countries. Could this be related to less human capital investment? The scant evidence which we have on human capital formation suggests that the Middle East and South Asia did not participate in the European human capital revolution.[20] Evidence on sixteenth-century Maghreb suggests that basic numeracy was only 10 percent in the late fifteenth/early sixteenth century, and around 50 percent in the period between the late sixteenth to early eighteenth century (Juif and Baten 2013). For eighteenth-century Turkey and Syria we have estimates in the range of 10-50 percent (Ghanem 2014). Similarly, in South Asia, numeracy stagnated around 30 to 40

[20] On this and the following five pages, see Ghanem and Baten (2016).

percent and the trend was probably downwards in the late 18th century (Baten and Fourie 2015). In the same time period, the numeracy in Europe grew from around 50 to 90 percent. As a result of higher human capital investments, Europe emerged to be a dramatically strong competitor in industrial exports. The higher human capital investments might have been partly driven by higher incomes. However, exogenous factors in form of religiously motivated educational investments, regional nutrition advantages (the "milk factor" in England, The Netherlands, Switzerland, later Scandinavia), middle-sized farm structure and other factors played a much larger role. This is supported by the fact that human capital - and especially numerical abilities - grew first, while the standard of living of the overall population grew much later (Baten 2016).

As late as 1800, the Ottoman Empire, which constituted the core region of the Middle East, was still completely self-sufficient in textile production, which represented a large share of traded industrial goods (Pamuk and Williamson 2011). Similarly, South Asia was exporting industrial goods to other world regions (primarily textiles) in the 18th century. However, the years around 1800 brought a dramatic change. Later on, during the 19th century, industrial goods were typically not competitive with British products (even taking into account the asymmetric colonial power distribution). However, the relatively strong status of industrial production in South Asia and the Middle East before 1800 indicates that the curse that we study here was not simply caused by the early modern development of these economies.

Pamuk and Williamson (2011) offer a trade-based interpretation of the process during which the Middle East deindustrialized. They point out that during the nineteenth century British imported textiles were outperforming many local producers. Furthermore, they noted the importance of improving terms of trade of cash crops, which can be

interpreted as an early "curse of resource" phenomenon. While we study below the resource oil in its impact on human capital formation in our article, one could also interpret cash crop production as a resource, which might not have had positive skilling effects, especially considering an alternative industrial development. Of course, this cannot be the focus of our study, as our school investment data only start in the 1880s.

We trace the number of school years by using the age-specific Barro and Lee (2013) data. The authors report the number of school years which the cohorts received, whose first decade of life were the 1880s, 1890s and so on until the 1980s. We assume that (1.) the survivor bias and (2.) going to school later in life do not strongly affect the results. The survivor bias was small and has been intensively assessed by economic history studies that focused on cohorts and their educational experience (on numerical survivor bias see Crayen and Baten, 2010). If there would be any bias, it would mostly affect the oldest cohorts of the 1880s and 1890s, making them appear to have received more school years than later cohorts. However, the number of school years was very low anyways, mostly between 0 and 0.5 years. They also cannot have collected a lot of additional schooling later in life for the same reason. Primary schooling was generally not very high during the nineteenth century (Figure 3.1). The only exception is Algeria, in which the French colonial schooling system resulted in slightly higher levels. Only during the early twentieth century, a strong improvement can be noticed. This effect of the deficit in the educational component numeracy is equally visible in the other components of education, such as literacy. Issawi (1982) noted that literacy was only 7 percent in Egypt in 1907 for example. During this time the governments spent little public funds on education. The 1860/61 Ottoman budget on education was only 0.2 percent of total expenditure. In Algeria, it was slightly higher with around 2 percent (1890-1914). Even during the early twentieth century, the number of

school years was quite low (see Figure 3.1). The most extreme was Yemen, where children received almost no schooling. In the Gulf states the situation was slightly better. Similar statements could be made about secondary and tertiary schooling, although we focus here on primary schooling. In the following we will consider growth of school years rather than the levels shown in Figure 3.1.

3.3 Potential explanatory variables for primary school investments

In the following we discuss a number of potential explanatory variables that we include in the regression analyses below. We begin with more general potential determinants, before we come to the factors of major focus in this study (the resource curse and colonialism variables). The other factors that we would like to control are (1) general development level of the country (2) fertility and quality-quantity trade-offs (3) the role of religious minorities and minority entrepreneurs (4) religious and secularism aspects in the design of the schooling system.

(1) General development level. We will include the growth of GDP per capita to approximate the change in the general developmental level of the countries below. Growing economies might have been able to invest more in education, even if a number of recent studies doubt the direction of causality from income to educational investment (Bleakley and Ferrie 2016; Hanushek and Woessmann 2012, study the effects of cognitive abilities on economic growth).

(2) Fertility and Quality-Quantity trade-offs. Following the seminal studies of Becker and Lewis (1973), a number of studies has argued that a larger number of children usually implies less parental investment into education. In other words, the parents maximize quantity, not quality of their offspring. Alternatively, Clark (2007) argued that in early

societies, rich and more educated population groups had a higher number of children, which would indicate that we might also expect a positive effect of fertility on school enrollment years.

(3) Religious minorities and minority entrepreneurs. Also the treatment of religious and other minorities could have been a positive or a negative factor for schooling growth. It might have been negative, if there was a harsh or even violent treatment of minorities, that generated brain drain, i. e., the emigration of the more skilled persons to other countries. Issawi (1982) concluded for the period just before WWI that almost all powerful positions in the Middle Eastern economies had been taken over by Europeans or minorities such as Armenians, Greeks, other Christian minorities and Jews. He interprets the following century as an attempt to reverse this development. Europeans and entrepreneurial minorities were forced or encouraged to leave, or sometimes killed (such as many Armenians in Turkey). To take an example, countries like Yemen lost their minority tradesmen (who might have developed into entrepreneurs later-on), and the relatively low level of human capital made it difficult to develop own Yemenite entrepreneurial groups (Ghanem and Baten 2016).

On the other hand, while the religious minorities were still present in the country, they might have had a positive effect. Weber (1904) argued that often religious minorities were more entrepreneurial in their countries than members of majority religions. We will test below whether religious minority effects were positive, because minority entrepreneurs could have promoted more educational efforts in their countries. On the other hand, it might also be possible that Christian or Jewish minorities were negatively correlated with school investments, because there might have been brain drain effects, when some minority groups might have started to leave the country.

(4) Religion in educational policies. Another institutional factor is the role of religion in educational policies.[21] Ghanem (2014) assessed whether separating religion from government had a positive influence on human capital in Turkey. The results confirm that being a secular state has led to a clear increase in numeracy levels in the different Turkish regions. New schools were built and primary schooling became mandatory and free. Turkey was more successful in developing own entrepreneurs, as the educational status had always been higher. Furthermore, the Ataturk reforms placed particular emphasis on education. In addition, Turkey also benefited from the slightly more equal gender distribution of education after the Ataturk reforms. We will assess this by dropping Turkey below in one specification and considering the Ataturk effect by comparing the coefficient of the sample with and without Turkey.

(5) The "Curse of Natural Resources". Sachs and Warner (1995) argued that countries that are overly abundant in resources are rather unsuccessful in terms of growth rates in comparison to competitors, as it was the case in Nigeria during the second half of 20th century, or Venezuela during the early 21st century (see also Auty 1993). Over a long period of time, resource-abundance was regarded as a growth driver. The opposing empirical evidence for the hypothesis of the resource curse in the 1990s came as surprise. As a result, a number of explanations have been developed. Sachs and Warner observed that resource-abundant countries often have exchange rates, which made production of secondary goods seem unprofitable. Thus, instead of producing secondary goods, these goods are imported

[21] There are more institutional explanations, but they usually refer to the whole Islamic world and not single countries. Kuran (1997) criticized the stability of (1) inheritance laws, which did not allow for capital accumulation, (2) the lack of legal frameworks for capital firms and (3) the religious trusts called waqfs, which locked capital resources in relatively inflexible institutions. Kuran was convinced that it was not colonialism or religious attitudes per se that was growth retarding, but the excessive stability of these law concepts. Another institutional interpretation was given by Rubin (2011): The development of credit institutions that circumvented religious constraints was more rapid in Christian Europe since the late middle Ages. Rubin argues that this was caused by the need of rulers to be legitimized by religious leaders. During the early period of Christianity, the first followers of this religion lived under Roman rule. The Christian religious leaders developed doctrines that implied separated religious and governmental power. In Christianity, there was always more tension and sometimes competition between religious and political leaders (Rubin 2011). As these institutional explanations refer to the whole Islamic Middle East, we cannot include specific variables in our country-specific regressions.

by countries that could pay with revenues from selling oil and other products. Further factors concern political economic issues, such as political instability, high public deficits, dictatorial government systems, as well as underinvestment in education. A number of studies on the developing world after 1950 have discussed whether oil and other resources result in specific types of political economies, in which small groups obtain great wealth and a large part of the population considers their share of income and political participation to be insufficient (van der Ploeg 2011).

There are at least three processes that could have causal power for the curse of resources even in the long-term perspective:

Resource extraction has in some cases led to a high degree of inequality in society. The reason behind that resource extraction, in comparison to other economic activities, only requires a relatively low number of workers. Thus, the profits are only divided between a small group of people, while the rest of society receives little revenues. This can be observed in some of the oil-producing countries, where the ruling class has accrued phenomenal material wealth. Of course, there are also exceptions (Gylfason and Zoega 2003).

Entrepreneurship seems to be hampered by the presence of resources, as profit can be made by resource extraction involving less risk and effort. Innovation and investment in education are therefore neglected, so that the prerequisites for successful future development are not given. Spain, for example, was wealthier than England in the 15th century. Its resource-rich South-American colonies meant high cash-inflow, but at the same time prevented the set-up of manufactories in Spain. Thus, it soon lost economic strength in comparison to other countries.

The third factor is a "military bias". Collier (2007) has recently pointed out the influence of oil and other mineral resources on the probability of civil wars. Furthermore,

Brunnschweiler and Bulte (2009) have pointed out that military conflicts lead to a higher resource extraction intensity. Observations show that resource abundant countries and their neighboring states have relatively high military spending and that the military is regarded as the most attractive field for the elites. Conquering resources in military conflicts is the easiest way to gain wealth and reputation. However, this means that talented and innovative entrepreneurs were missing in other industries and services, and that the actual basis of development in a country is eroding, in particular as the subject of further conquests is increasingly unattainable.

It would be tempting to include interaction terms of inequality and oil production, as well as interaction terms of military spending and oil production, in order to assess in greater detail the channel via which the oil curse might work more precisely. However, evidence on these variables is only available on a small number of countries, and only on a very recent period, hence this interaction term strategy is not possible. At the present stage of knowledge, we need to consider the oil curse as a black box, and can only explain what might have happened inside.

At the same time, many earlier studies juxtapose the benefits of resource abundance to its drawbacks. For example, coal reserves might have fueled the industrial revolution in England. Allen (2009) argued that technical innovations, such as steam engines, were easier to realize than elsewhere due to the proximity to coal (Allen 2009). The interaction of rich resource occurrences and fairly growth-promoting institutions rather seems to be a blessing in some countries (see Norway and Botswana during the later 20th century). But so far, no studies have yet analysed the influence of these developments on human capital development during the period under study here, even though its history can offer a better understanding of resource curses – or blessings.

Oil production will be our main variable for assessing the resource curse effects. In 1908, oil was discovered in the Middle East. This discovery completely changed the landscape of its economies. During the pre-WWII period, most oil mining took place in Iran and - on a much smaller scale - in Egypt. Only during the 1940s, Iraq also became a major exporter and also oil exports from Bahrain and other Middle Eastern Countries increased (Figure 3.2). Up to 1940, the Middle Eastern and North African oil production was still below 5 percent of world production. However, it quickly exploded to 26 percent in 1960 and a maximum of 42 percent in 1975. The cartel policy of the OPEC during the Arab-Israel conflict of 1973 and later in the 1970s generated a flood of revenues for the oil states Iran, Iraq, Kuwait, Saudi Arabia, Qatar, United Arab Emirates, Egypt, Libya, Algeria, Bahrain and Oman (Oman, and also Syria, Israel and Turkey had quite small revenues). In contrast, other primary resource exports were of fundamentally smaller importance for the countries under study here. Hence, we will focus on oil only. Our source is based on Etemad et. al. (1991), World Energy Production 1800 – 1985. Data from 1980 and thereafter is from U.S. Energy Information Administration, International Energy Statistics.

(6) Colonialism. Most provocatively, Niall Ferguson (2011) has argued that colonialism implied a modernization program for the colonized countries. He argued in a particularly provocative way that the alternatives to colonialism were worse. The colonies benefitted from the Western attitudes that he calls "Killer Apps", namely competition, science, democracy, medicine, consumerism and the work ethic. The imagination that these rulers or their successors could have adapted growth-promoting institutions later-on is, in Ferguson's view, naive. While Ferguson referred to many examples from Africa, the view could also apply to the Middle East and South Asia. Heldring and Robinson (2012) recently described the interpretations of colonialism coming from the far left of the political

spectrum and the liberal or right-wing ones. On the far left, Lenin interpreted colonialism – and the type of imperialism to which the Western European powers switched during the late 19th century – as a modernizing force. This is supported by more recent Marxist texts, such as Sender and Smith (1986). On the other side of the political spectrum, the predecessors of Ferguson's positive views were colonial administrators and scholars who share this view, such as McPhee and Wright (1926). Heldring and Robinson conclude their historical overview of colonialism (including positive and negative views) with the statement that this wide scope of different views is only possible, because evidence is scarce. The colonial developments might have resulted in less educational investment. In fact, until the 1940s, the colonized countries in our world region had lower human capital investment (Figure 3.3, Table 3.1). However, this might have been caused by composition effects, which can only be disentangled in regression analyses below. Our data source for colonialism is Olsson (2009).

3.4 Regression Results

Our model for the estimation of human capital has the following form:

$$dSchool_{it} = \alpha + \beta 1\ oil_{it} + \beta 2\ colonial_{it} + \beta 3\ initialSchool_{it} + BX + \gamma_i + \mu_i + \varepsilon_{it}$$

The dependent variable dSchoolit is our measure for growth of human capital investment. This input measure of human capital reflects the increasing or decreasing willingness of tax payers or their government to spend in the respective country i and decade t on primary school children, relative to the previous decade. We test both oil production per capita (in logarithmic form) and colonialism as potential determinants of schooling investments. We add initial schooling to account for convergence effects: In countries with high initial schooling, the growth rate might have been more limited. X is a vector including control variables, such as religion or fertility.

In all specifications we include robust p-values in order to cope with heteroscedasticity, because, as is common in this kind of dataset, the variance of the residuals is not identically distributed across all fitted values. We cluster the standard errors by country. This also prevents potential problems with autocorrelation.

In the econometric specification above, the additional set of country dummies captures other, unobservable factors that could have had an effect on human capital investment growth for all countries i, using the country fixed effect γi. Similarly, we include a time fixed effect for half-centuries μt. Table 3.2 provides an overview of the summary statistics for the variables included in the model. The Skewness/Kurtosis tests for normality indicate that oil production was right skewed; hence, we chose to take the natural logarithm of this variable.

Based on this basic model of human capital investment growth, we perform panel-data analyses of the effect of oil production and colonialism (Table 3.3). Oil production has in fact a negative and significant effect on the change in schooling rates, whereas colonialism did not have a consistent effect. Initial schooling has a negative effect that is mostly significant, indicating a certain degree of convergence. A not negligible part of the variation in growth rates in this period can be explained by the specific right-hand side variables (see specification (1)).

In specification (2), we add time fixed effects, because a year of school investment has meant different things in the late 19th and the late 20th century. In the third specification, we exclude Israel as it could have been an outlier due to its very special migration and religious history. Finally, in specification (4) we drop Turkey in order to study whether the resource curse was perhaps in reality an Ataturk reform effect, because Turkey did not have much oil, and invested heavily in its secular schooling system. By comparing the

coefficient of the sample with and without Turkey, we can identify that the oil curse effect was similar in both specifications.

In fact, in each of the specifications oil production has had a significantly negative impact on the dependent variable. When examining the coefficients, we can observe that a one standard deviation increase in oil production leads to a 0.06 decrease in schooling growth. This corresponds with 17 percent of a standard deviation of schooling growth and is hence an effect which should not be neglected. If we consider the instrumental variable estimation, which we will discuss below, we arrive at a value of 78 percent of the size of the standard deviation, which is quite a substantial effect.

These results can also be demonstrated in a graphical way for the bivariate perspective. If we consider the countries that had at least some oil production (greater than zero) we observe that there was a number of country-decade observations in the Middle East, where oil was not available or detected yet, but human capital investment was relatively strong, such as Egypt or Iran both in 1910 (Figure 3.4). On the other hand, in the countries which had a very substantial oil production per capita, such as Emirates (AE) 1970s, Kuwait 1950s or Libya in the 1980s we observe relatively low human capital investments. Hence, if we take the whole sample into account, we observe a negative relationship, even though there are also countries with little oil and negligible human capital investment. This relationship becomes even stronger if we consider Iraq 1950 as an outlier.

Intuitively, an increase in income would be expected to lead to increasing school investment. Therefore, we analyzed the effects of controlling for an increase in GDP. Actually, the signs and the size of the coefficients on oil production remain virtually unchanged (Table 3.4). The change in GDP by itself is significant in one of the former

regression models. Thus, there might be a modest contribution of income growth to schooling investment but it does not make the "curse" indicator insignificant.

In addition, we would imagine that religion and fertility might play a large role for the Middle East and South Asia. Countries with a high fertility increases are perhaps not able to invest in additional schools proportionally, due to the quality quantity trade-off, as explained above. Additionally, religion could have played a role if we assume that there is an exogenous influence of some religions to especially increase reading abilities. This has been argued for the Jewish religion (Botticini and Eckstein 2007) as well as the Protestants (Becker and Woessmann 2009). However, Protestantism does not play a major role in this world region. As Christians and Jewish were mostly minorities in the countries under study, an alternative interpretation of these variables would be the minority-entrepreneur-effect, or the brain-drain effects when they left, that we discussed above. After including these effects, we find a modest influence of Christianity in some of the models and a very modest influence of fertility, but with a positive sign, suggesting a Clarkian interpretation. Nevertheless, the curse variable which interests us most in this analysis remains significantly negative.

Finally, we need to think about issues of endogeneity. We would not imagine that reverse causality could be a major problem, because it seems unlikely that increasing educational spending would strongly influence oil production: The share of locally employed persons was very small (except in some very small gulf countries). Furthermore, the know-how came from foreign experts; hence the overall schooling probably did not have a strong influence. However, all macroeconomic regressions are suspicious of either reversed causality, or endogeneity caused by omitted variable issues or measurement errors. Hence, we report the results of an instrumental variable regression (Table 3.6 and 3.7). The

instrument for oil production, namely oil reserve, has been used in previous research studies (see the overview of Van der Ploeg, 2011). The oil reserves per capita in the country reflects not the actual production (which is more at risk of endogeneity), but the amount of reserves which are known at present and which could have been used already in earlier times, assuming that technologies would have been developed to mine them. Our source is the World Factbook (2015), although different institutions published different estimates. This is a debatable assumption, but in the Middle East since the heyday of oil production in the 1970s technological progress was substantial, but not tremendous (in contrast to Canada and the US, for example, where completely new technologies such as fracking were developed).

In the first stage, we observed that oil reserves are strongly correlated with oil production. The F-statistic is consistently larger than 10, which indicates strong instruments. Considering the validity of the exclusion restriction, it is difficult to imagine that the amount of resources in the ground has an influence on schooling investments other than via oil production. So, the exclusion restriction probably holds.

3.5 Conclusion

Our study considered the effect of oil production on human capital development. Hence, we have chosen the schooling rate as the dependent variable. As the Middle East and South Asia both were subject to colonialism during the analysed time frame, colonialism was also considered as an explanatory variable.

On the basis of a panel data analysis and instrumental variable estimation we have found strong and negative effects of oil production on the change in schooling rates. In contrast, colonialism did not have an effect in the Middle East. Initial schooling negatively

impacts on the change of schooling rates, which suggests a certain convergence effect. We performed a number of robustness checks in order to counter check whether the oil effect is consistently related to lower educational growth. We included the change in GDP, for example, in order to assess whether there might have been an income effect, which suggests that richer countries might have invested more in education. This, however, did not change the effect of oil production. Furthermore, neither controlling for the effect of religious minorities nor fertility effects were able to significantly reduce the curse of oil, which was observed here. Our instrumental variable regression suggests that we can be relatively sure to interpret the observed relationships as causal. Overall, we show that some of the observed countries had a weakness phase specifically after WWII when oil production grew rapidly. During this time frame these countries should have invested more into education and into the future.

In the period after our time frame, namely the 1990s to 2010s, the Gulf economies, which have a particularly high share of oil production, have been investing in education heavily (Van der Ploeg, 2011). Hence, the deficit of investment we observed in the 1950s and 1960s might have been removed. However, as these policies can be easily reversed – for example if there would be a wave of anti-educational religious extremism - our findings are of policy relevance.

3.6 References

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3.7 Tables

Table 3.1 Share of Colonized countries, by region

Region	*1850*	*1900*	*1950*
ME-Center	0.05	0.12	0.00
ME-East	0.00	0.00	0.00
ME-Gulf	0.50	0.90	0.63
N. Afr.	0.33	0.80	0.31
S. Asia	1.00	1.00	0.00

Source: Olsson (2009)

Table 3.2 Descriptive Data

Variable	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
School year growth	247	0.33	0.35	-0.37	3.01
Colony	247	0.38	0.49	0.00	1.00
Ln(oilpc)	247	-0.93	3.16	-2.30	12.08
Christ	247	2.76	3.27	0.00	10.00
Jewish	247	3.74	17.36	0.00	84.00
Hindu	247	10.18	25.22	0.00	86.00
Years of chooling	247	3.23	3.37	0.01	13.10

Source: see text

Table 3.3 LSDV regressions of the growth of schooling investments

	(1)	*(2)*	*(3)*	*(4)*
Excluded	None	None	Israel	Turkey
Colony	0.041	0.012	0.009	0.013
	(0.469)	(0.854)	(0.897)	(0.852)
Oil p.c. (log)	**-0.019*** **	**-0.015***	**-0.015***	**-0.015***
	(0.010)	(0.061)	(0.070)	(0.087)
Christian	-0.030***	-0.024***	-0.024***	-0.024***
	(0.000)	(0.000)	(0.000)	(0.000)
Jewish	-0.004***	0.001		0.001
	(0.000)	(0.788)		(0.758)
Hindu	-0.001	-0.003**	-0.003***	-0.003**
	(0.167)	(0.010)	(0.010)	(0.010)
Initial schooling	-0.013	-0.080**	-0.082**	-0.082**
	(0.272)	(0.038)	(0.042)	(0.037)
Country FE	Yes	Yes	Yes	Yes
Time FE	No	Yes	Yes	Yes
Constant	0.567***	0.996***	1.010***	0.470***
	(0.000)	(0.001)	(0.001)	(0.000)
Observations	244	235	224	223
Adj.R2	0.12	0.24	0.22	0.23

Notes: Dependent variable: Growth of Schooling, augmented in most models with growth of numeracy. All specifications include heteroskedasticity robust p-values, clustered by country. We performed Least-Square-Dummy-Variable estimates that are equivalent to panel fixed effects estimates. Time fixed effects are half-century specific. Robust p-values in parentheses: ***p<0.01, **p<0.05, *p<0.10

Table 3.4 Including GDP growth: LSDV regressions of the growth of schooling investments

	(1)	*(2)*	*(3)*	*(4)*
Excluded	None	None	Israel	Turkey
Colony	0.039	0.013	0.012	0.016
	(0.486)	(0.846)	(0.857)	(0.812)
Oil p.c. (log)	**-0.020*** **	**-0.015***	**-0.014***	**-0.015***
	(0.007)	(0.056)	(0.082)	(0.075)
GDP p.c.	0.302*	0.053	0.075	0.061
	(0.054)	(0.801)	(0.722)	(0.773)
Initial schooling	-0.015	-0.080**	-0.084**	-0.081**
	(0.237)	(0.041)	(0.040)	(0.041)
Country FE	Yes	Yes	Yes	Yes
Time FE	No	Yes	Yes	Yes
Constant	0.439***	0.895***	0.235***	0.165***
	(0.000)	(0.002)	(0.004)	(0.002)
N	247	235	236	231
Adj.R2	0.211	0.320	0.312	0.329

Notes: See table 3.3

Table 3.5 Including religion and fertility: LSDV regressions of the growth of schooling investments (smaller sample)

	(1)	*(2)*	*(3)*	*(4)*
Excluded	None	None	Israel	Turkey
Colony	0.033	-0.038	-0.039	-0.034
	(0.555)	(0.194)	(0.177)	(0.295)
Oil p.c. (log)	**-0.024****	**-0.018****	**-0.017****	**-0.018****
	(0.012)	(0.016)	(0.018)	(0.039)
Fertility	0.046*	0.004	-0.004	
	(0.094)	(0.459)	(0.878)	
Christian		0.017***	0.006***	-0.004***
		(0.000)	(0.001)	(0.001)
Jewish		-0.000		-0.002**
		(0.782)		(0.050)
Hindu		0.000	-0.000	-0.002***
		(0.352)	(0.208)	(0.001)
Initial schooling	-0.006	-0.019	-0.024*	-0.021
	(0.705)	(0.155)	(0.058)	(0.139)
Country FE	Yes	Yes	Yes	Yes
Time FE	No	Yes	Yes	Yes
Constant	-0.069	0.102	0.030	0.035
	(0.786)	(0.347)	(0.791)	(0.108)
Observations	114	102	103	98
Adj.R2	0.226	0.291	0.263	0.308

Notes: See table 3.3

Table 3.6 Instrumenting the Curse of Oil, First Stage (instrument: oil reserves)

	(1)	*(2)*
Oil reserves pc	**30.4***	**28.8***
	(0.059)	(0.068)
Constant	-1.127**	-1.128**
	(0.046)	(0.048)
Number of Obs	236	236
F(7 , 228)	13.38	
F(6 , 229)		14.54
Prob > F	0.00	0.00

Notes: See table 3.3

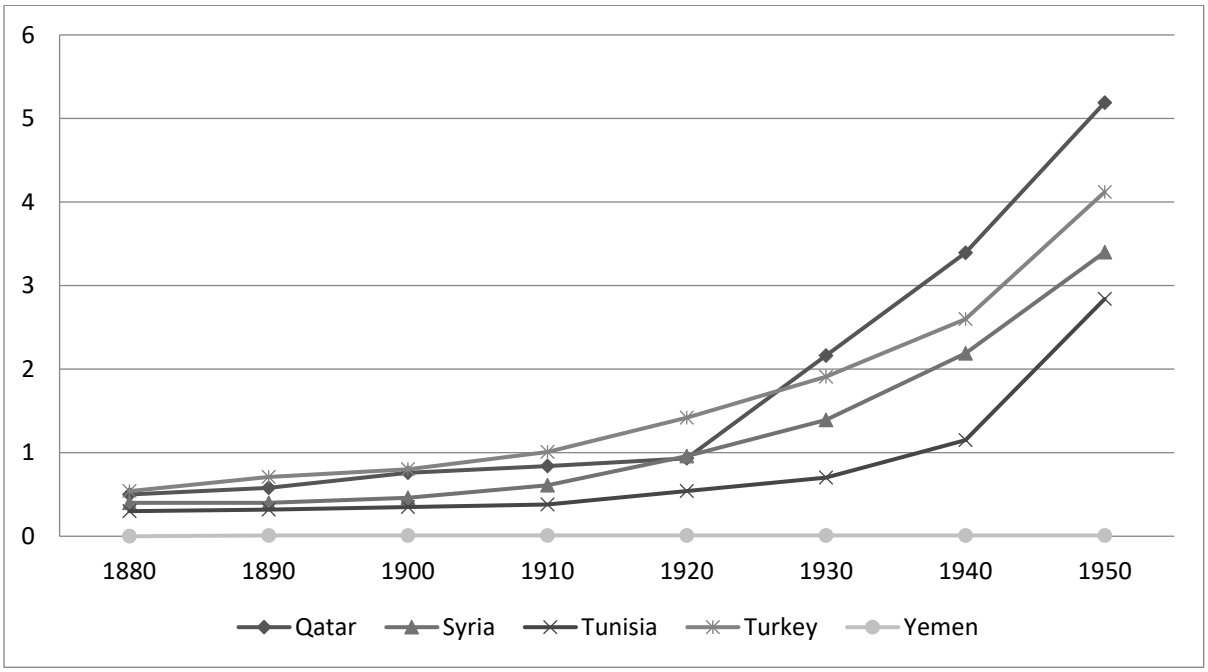
Table 3.7 Instrumenting the Curse of Oil, Second Stage (instrument: oil reserves)

	(1)	*(2)*
Dependent Variable	Change in Years of Schooling	Change in Years of Schooling
Oil production (log)	**-0.075***	**-0.086***
	(0.098)	(0.051)
GDP change	**0.380*****	
	(0.000)	
Country FE	YES	YES
Constant	0.253***	0.240***
	(0.000)	(0.000)
Observations	236	236
R-squared	0.078	0.025

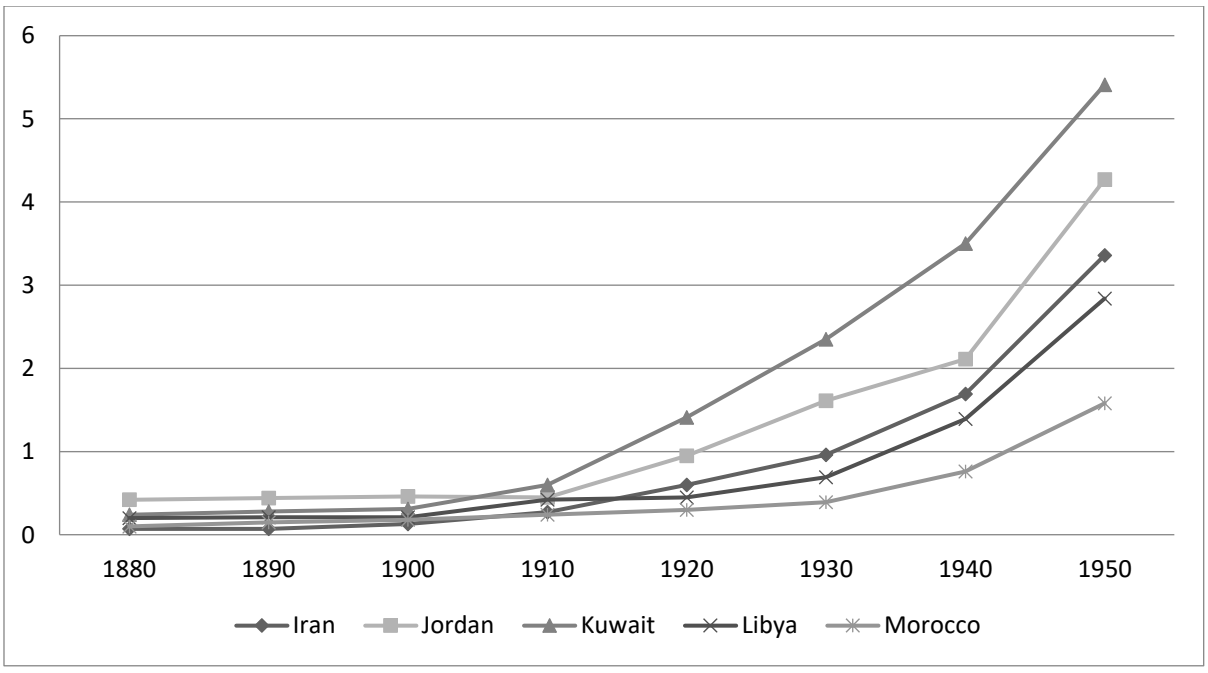
Notes: see table 3.3

3.8 Figures

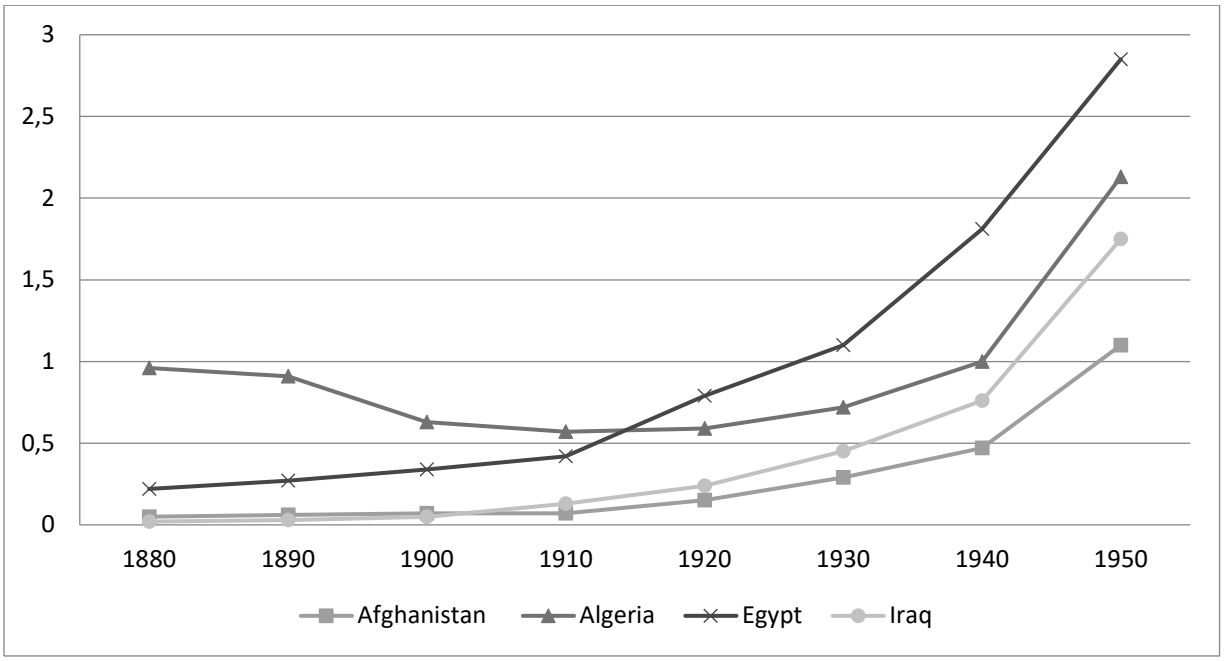
Figure 3.1 Years of Schooling in Middle Eastern and South Asian countries, by birth decade
Panel A:



Panel B:



Panel C:



Source: Calculated from the Barro-Lee database http://www.barrolee.com/, but arranging all data by primary school decade (i.e. the decade, in which a cohort was around 10). This assumes no strong survivor bias distortion and no strong adults schooling (See Ghanem and Baten 2014)

Panel D:

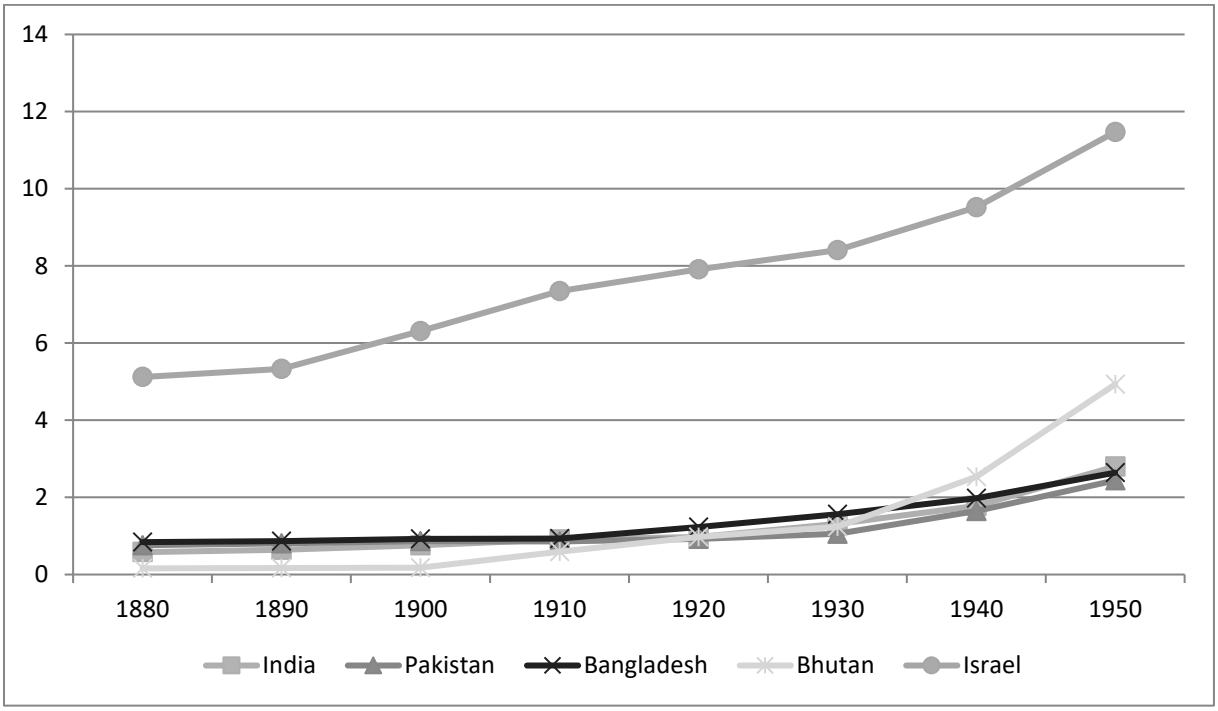
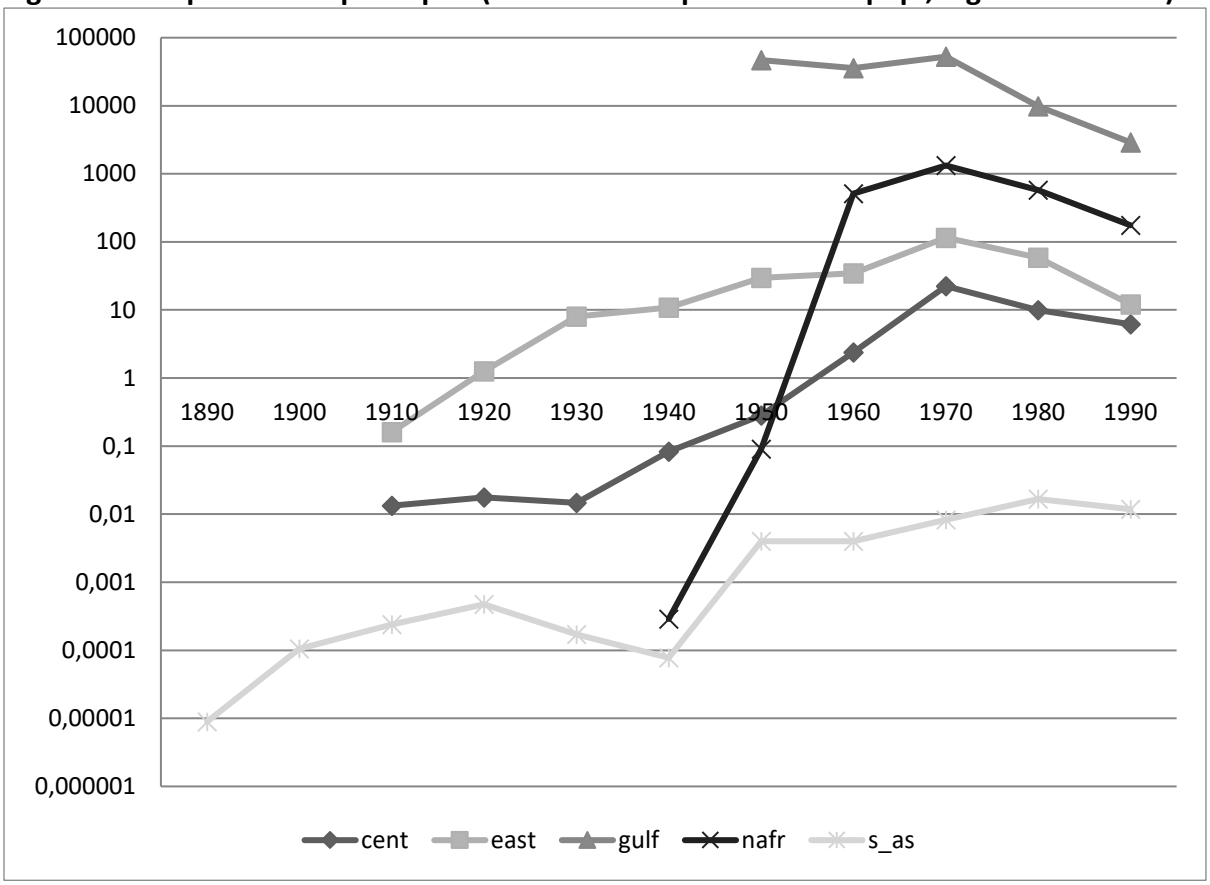
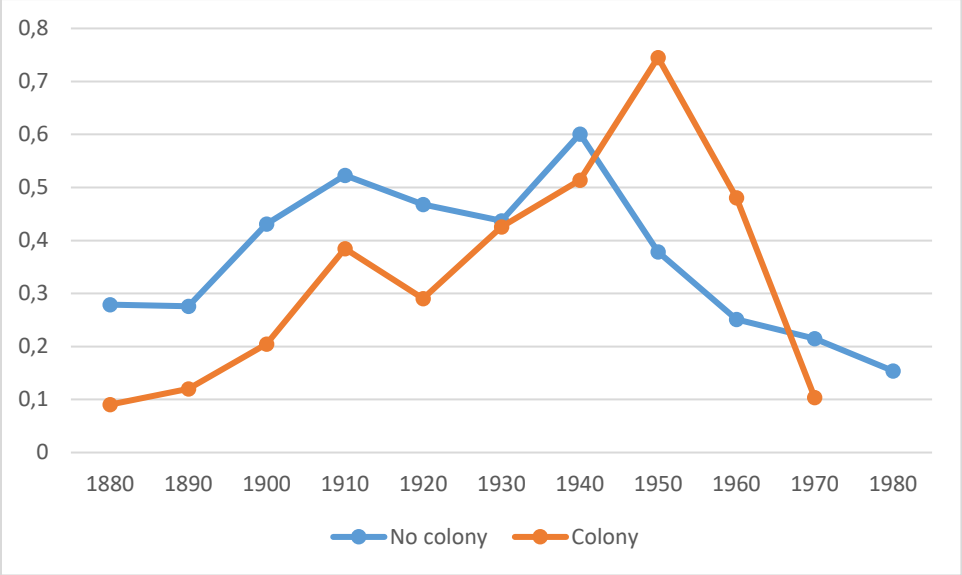


Figure 3.2 Oil production per capita (in metric tons per thousand pop., logarithmic scale)



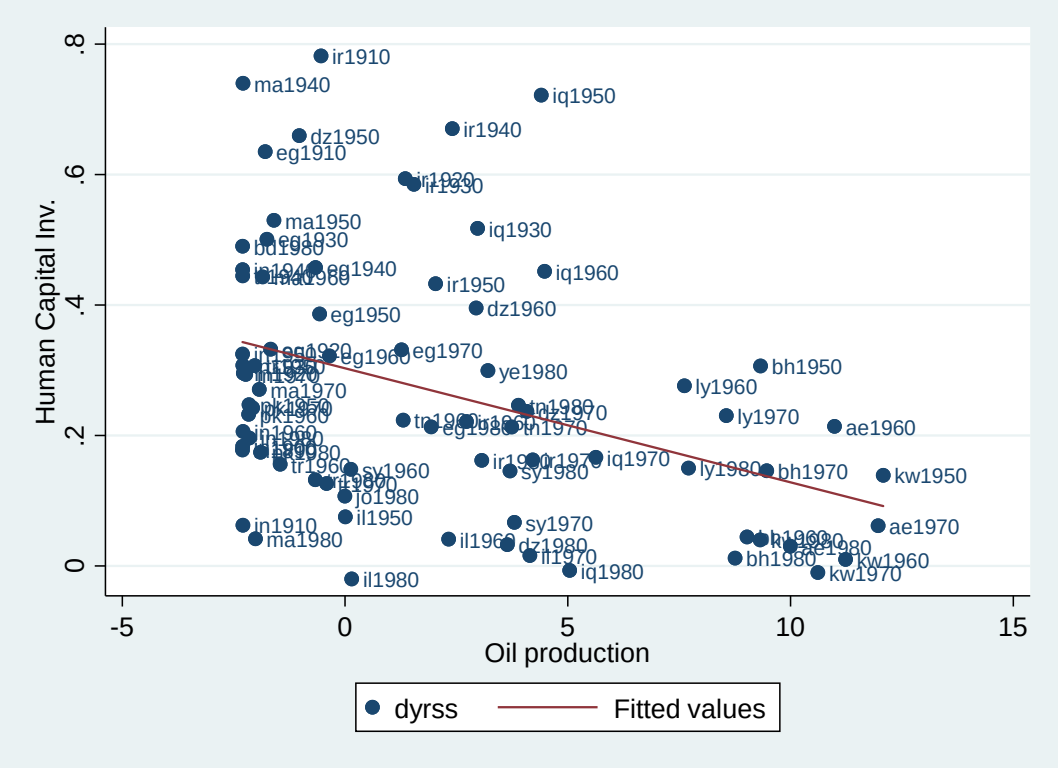
Regions are defined: cent – Egypt, Israel, Jordan, Lebanon, Syria, Turkey. East: Iran, Iraq, Afghanistan. Gulf: Saudi-Arabia, Qatar, U.A.E., Bahrain, Oman, Yemen. nafr: Algeria, Lybia, Morocco, Tunisia. s_as: India, Bangladesh, Pakistan, Sri Lanka, Myanmar (and the territorial predecessors of these countries)

Figure 3.3 Human Capital in the Middle East and South Asia by colonial status



Note: We use Olsson's definition of colonies. He explains his definition "A Western colony is a new and lasting political organization created outside Europe by Western countries (countries in Europe excluding Russia but including the Western offshoots United States, Australia, New Zealand, and Canada) from the 15th to the 20th centuries through either invasion and conquest, and/or settlement colonization. Its rulers are in sustained dependence on a geographically remote mother country or imperial center that claims exclusive rights of possession of the colony or in other ways strongly dominates politics in the country. Using this definition means that we restrict our sample in a number of ways. The requirement that the colony in question must be dependent on a particular Western country implies that we exclude a number of countries in the Middle East such as Syria, Iraq, and Jordan which were ruled by Western countries in the wake of World War I on a mandate from the League of Nations. We also exclude Ethiopia, the only country in Africa that was never a colony."

Figure 3.4 Oil Production and Human Capital in the Middle East and South Asia



4. Human Capital Development: Evidence from Ottoman Turkey, Syria, Palestine and Iraq the 18th and 19th centuries

4.1 Introduction

Despite a wide range of studies of the history of the Middle East, the quantitative studies about the economic history of the area are few, and more studies are needed to enhance our understanding of the development of human capital in this region. The biggest problem that researchers of Middle Eastern economic history face is the scarcity of data. Unfortunately, it is not easy to find the required data about this area for various reasons. In this paper, I will present a large data set which is taken from documents that exist in the Ottoman archives in Istanbul. These data will be analyzed to obtain a better understanding about the economic history of the Middle East during the 18th and the 19th centuries.

The technique applied in this paper is the "age heaping methodology". It relies on the ability of people to declare their exact ages without rounding them to numbers ending with zero or five. The ABCC index is a measurement that calculates the share of people that are able to state their age correctly and reflects the estimated share of people who have minimal numerical skills in the sample. This index will be calculated for a sample of individuals that were living in different regions in the Middle East during the 19th century.

The data used in this research comes from censuses that were carried out the Ottoman Empire during the 19th century. Our sample covers several provinces in today's Turkey, Iraq, Syria and Palestine. It contains statements of age by males who were living in 20 different districts in the Ottoman Empire and were between 23 and 72 years old during the first half of the 19th century. Around eight birth decades are covered, beginning in the

mid-18th century. Individuals are divided according to their religions and place of residence. The data allow us to calculate the different ABCC values for each group, according to their birth decades, place of residence, province and religion.

Did Muslims have better numeracy than Christians and Jews? Was there a significant difference in human capital between today's Arab and Turkish regions? How big was the effect of living in a large city on human capital in Ottoman regions in the 19th century? And was there a significant influence of being a city located on a trade route?

By applying the age heaping methodology, including other variables contain information about the distance from a caravan route or a coast and the city size in addition to the geographical, religion and time variables, the regressions in this paper will try to answer the above questions in order to provide us with evidence about the development of human capital in the Middle East during the 19th century.

4.2 The Age Heaping Methodology

In order to measure the quality of a country's human capital, one can use a variety of indicators such as educational attainment, the investment in the country's education system, literacy rates and a variety of other benchmarks. The problem that researchers face in this domain is the lack of data when it comes to a historical period of time, where it is not possible to obtain the required data to calculate such indicators. The age heaping method was introduced to solve this problem in part. Relying only on age records, one can acquire an indicator of a region's human capital. Age heaping is the phenomenon of rounding ages to milestone numbers such as a multiple of five. When the individuals lack a basic level of numeracy, they may find it difficult to calculate their ages accurately, thereby rounding their ages to numbers ending with zero or five (Baten et al. 2010). In some countries, people even

tend to choose numbers other than zero or five, when they have a special value in their cultures. Since the Middle of the twentieth century, researchers proved the existence of the age heaping phenomenon around the world, such as in the 1901 census of Ireland (Budd and Guinnane 1991), in the 1950 census of the United States (Myers 1954), and in different countries of Latin America in the previous three centuries (Manzel et al. 2012). Researchers also showed a correlation between age heaping and literacy rates (A'Hearn et al 2009). This method has been used to indicate numeracy levels, thereby approximately human capital.

4.3 The Whipple Index and the ABCC Index

One of the most accurate measurements of the heaping is the Whipple index (A'Hearn et al. 2009). This measure is based on calculating the ratio between the number of rounded ages in a sample to the one fifth of the total number of stated ages resulting in a number between 100 and 500. The index is calculated by including the declared ages of survey participants aged 23 to 72 years. When the Whipple index reaches 500, this indicates the lowest possible numeracy level, where the entire population state their ages in multiples of five. However, when the Whipple index is equal to 100, that means all individuals have the basic numeracy level that enables them to calculate their ages accurately.

$$Wh = \left[\frac{\sum (age\ 25 + age\ 30 + \cdots + age\ 70)}{1/5\ \sum (age\ 23 + age\ 24 + age\ 25 + \cdots + age\ 72)} \right] \times 100$$

In their 2009 research, A'Hearn, Baten and Crayen introduced a linear transformation of the Whipple index to provide simpler interpretation for age heaping. The new index was named after the initials of their names in addition to Gregory Clark's who suggested the name. In this paper, the ABCC index is used to measure the numeracy levels of different

regions in the Ottoman Empire. This index shows the ratio of the individuals who were able to state their ages accurately.

$$ABCC = \left[1 - \frac{(Wh - 100)}{400}\right] \times 100 \; if \; Wh \geq 100 \; ; else \; ABCC = 100$$

The ideal value of the Whipple index of 100 will lead to the ideal ABCC value of 100. In this case, all the sample individuals could calculate their ages without rounding and they have the best possible numeracy level. Conversely, when the Whipple index equals 500, the ABCC value will be zero showing that the entire population stated ages ended with zero or five. The ABCC index not only shows us the average numeracy level of a country, but it can also be calculated for the different age groups in the sample, enabling us to differentiate between their numeracy levels. In this paper the sample is divided into five age groups of ten years each, and two rounded ages. The five age groups are: 23-32, 33-42, 43-52, 53-62 and 63-72. The birth decades are also calculated using these age groups and subtracting them from the census year.

4.4 Data Description

The Ottoman Archives in Istanbul keep a treasure trove of documents covering not only Turkey, but also the former Ottoman states in the Middle East and Eastern Europe. The data for this paper was collected at these archives which mainly stem from thirty five different records. These records form parts of around fourteen censuses which were carried out in the different regions of the Ottoman Empire between 1830 and 1851. Those censuses included only the male inhabitants of the surveyed areas. Their names, ages and other characteristics such as tall, short or bearded were registered in the Ottoman language, which used to be the official language of the Ottoman Empire. This language used the Arabic alphabet from around a century before the reforms were imposed on the Turkish language which caused it

to adopt Latin letters. Using census data enables us to get rid of the potential selectivity problem of the dataset as the sample is supposed to be representative of the male population across the regions under study.

The area covered in this dataset is now located in Turkey, Iraq, Syria and Palestine (See Figure 4.1). During the nineteenth century, these countries were states of the Ottoman Empire and their borders have since changed. Back then, they were called Eyalets (states) and they were divided into Sanjaks (districts); the Sanjaks themselves were divided into Kazas (sub-districts) and the kazas into villages. The Data were collected from nine Eyalets: Aydin, Bolu, Haleb, Istanbul, Marash, Mosul, Sham, Rakka and Sayda. Around twenty Kazas are included in these Eyalets. In this paper the collected data is restructured geographically according to today's borders to form ten regions: five in Turkey and the other five in Syria, Iraq and Palestine. The Turkish regions are divided into: Istanbul and Kocaeli, located in the North West of Turkey, in Marmara region. Aydin in the west of Turkey, located in the Aegean region; and Marash which is nowadays called Kahramanmarash, and is located in the Mediterranean region in the south of Turkey. In the south, there is also Diyarbekir which is now a province in the Southeastern Anatolia. The Arabic regions are: Aleppo, which used to be an eyalet during the Ottoman Reign and mainly covers the northern western part of today's Syria, including Aleppo and Edleb in addition to Alexandretta, which became a part of Turkey in 1939 and Ayintab, which is today called Gaziantep, in the South of Turkey. The second Syrian region is Damascus, which used to be called Sham, and was an eyalet that used to cover a large part of the central and southern regions of today's Syria as well as parts of Jordan, Lebanon and Palestine. The last Syrian region is Rakka, covering its Northeast. Rakka was an eyalet as well, and its data was included as a subsection of the Aleppo eyalet. The fourth Arabic region is north Palestine, covering today's Acre, Algalil and Nablus regions.

In the first half of the nineteenth century, this area was a part of the Sayda eyelet, which used to be located in today's Lebanon and Palestine. The last region is Mosul, which was an eyalet located in northern Iraq.

The censuses that we use were taken in thirteen different years between 1830 and 1851. Covering these twenty one years, this dataset enables us to calculate ABCC values for seven birth decades according to the five age groups outlined above after subtracting each age group from its census year. These birth decades are those between 1760 and 1820, and the people who were born during those decades were between 23 and 72 years old between 1830 and 1851.

The census records in the Ottoman Archives in Istanbul are not only classified according to their census year and geographical location, but also according to the religion of the census participants. Muslims were included in their own records, while all other religions[22] were included together in registers under the classification of "Reaya Defteri". This referred to non-Muslims who lived in Muslim states, "reaya" had to pay the "cizye", which is a head tax on non-Muslim individuals collected by their Muslim government (Shaw 1978). This classification enables us to calculate the ABCC index for Muslims and non-Muslims individually and compare the results to test if there was a significant difference between the average numeracy levels of the different religions. Unfortunately, the non-Muslims are not clearly divided according to their religions to be able to differentiate the Christians and the Jews, for example. Even though it might be possible to classify some individuals into their religions by using their names, it is not possible to classify all individuals in this manner. Therefore this research will be focused on the differences between Muslims and non-Muslims.

[22] Non-Muslims were from different religious communities. In 1885, the main communities were: Greek Orthodox, Armenian Gregorian, Bulgarian, Greek Catholic, Armenian Catholic, Protestant, Latin, Jew, Maronite, Frank and some other minor communities. (See: Shaw, 1978)

The ten regions mentioned above are all in today's Middle East which, in general, used to play an important role in international trade. But not all of these regions have the same characteristics. Some of them were located directly on important trade routes in the early nineteenth century. The ports of Alexandretta and Latakia on the Mediterranean connected Aleppo with Europe, while the caravan route across Iraq connected Aleppo with India. Istanbul, Diyarbekir and Damascus were also located on caravan routes connecting the East with the West and the North with the South (Owen 1993). Being located on a caravan route is included as a variable in our empirical analysis, and is expected to have a positive influence on the numeracy level of the inhabitants of cities along these routes. This dummy variable is coded as 1 if the city is located on trade route and 0 if it is not. The data of the caravan routes are taken from a map of the Middle Eastern caravan routes in the Middle East from 1800 (Owen 1993).

4.5 Data Analysis

By graphing ages, Figure 4.2 shows that the inhabitants of the Ottoman states during the first half of the nineteenth century used to heap their ages to multiple of five. However, younger people seemed to state rounded ages less than the older ones. The states which are located now in Turkey seem to heap their ages less than those which are now located in the Arabic countries (See Figure 4.3). For the young and the old age groups, the Arabic and the Turkish regions seem to display similar behavior concerning age heaping. For the middle age group, however, the Arabic regions seem to heap more to numbers ending with zero than the Turkish regions, and the Turks tend to heap their ages less than the Arabs within this group. Dividing the data into two groups according to religion, the Muslims present more rounded ages than the non-Muslims except for those aged 25 and 30 (See Figure 4.4).

After calculating the ABCC index, we can see that the average value for the sample is 29. This means that, according to our sample, less than thirty percent of the Ottoman Empire population were able to calculate their ages accurately. The Turkish regions did better, with an average ABCC value equal to 34, while the aggregate Arabic average ABCC value is only 20. The poor education standards in the Ottoman Empire during the first half of the nineteenth century could be behind these results. Bayat (2003) states that the educational institutions in this period mainly consisted of religious schools and the most important problem was, that even if some schools existed, there was no specific curriculum to teach the children, so each teacher used to teach whatever he knew with no plan set by a governmental committee. However, there was a difference in the average value of the ABCC index between the Muslims and non-Muslims. While the average ABCC for Muslims in the Ottoman states in the first half of the 19th century did not exceed 25, the Non-Muslims scored an ABCC value of around 35. In general, the analysis shows better results for the Turks, and better results of the non-Muslims for both Turkish and Arabic states. With an average ABCC value of 11.84, the Muslim Arabs have the lowest numeracy rate, while the value for non-Muslim Turks exceeded 38 (See Figure 4.5).

In order to investigate the development of numeracy in this region, the ABCC index is calculated for the different birth decades between 1760 and 1820. The values begin around 10 for the first birth decade and reach 58 for the youngest group born during the 1820s. For the first and last birth decades, the Turks and Arabs look to have similar ABCC values; but this is not the case for the other five birth decades, where the Turks exceed the Arabs by around 20 points (See Figure 4.6). The values for both Muslims and non-Muslims are similar with a difference of around only ten points across all of the birth decades except for the 1810 birth decade where, surprisingly the difference exceeds the 30 points in favor of non-

Muslims. Muslim ABCC values increase for the first three birth decades before declining and staying stable for the second three birth decades and then jumping suddenly by more than forty points in the last birth decade (See Figure 4.7). This difference might be caused by the small number of observations for the Muslims born in the 1820s (See Figure 4.8). The difference between the ABCC values by religion in Arabic regions during the seven birth decades stay between ten and twenty points in favor of non-Muslims, but in the Turkish regions, there are fluctuations of the values between the Muslims and the non-Muslims during this period (See Figure 4.9). The difference seems to be small for the first five birth decades, but it grows to around 30 points for the group born in 1810, in the favor of non-Muslims. This changed dramatically in the next birth decade, where Turkish Muslims experience an increase of more than 30 points, becoming the most numerate group. However, the number of observations for the Turkish sample in the last birth decade of 1820 is low in comparison to the other birth decades, with around 2% of the total number of observations of Muslims, and 10% of the total number of non-Muslim observations. Although the average ABCC value for non-Muslims was better than the Muslims' value for both the Arabic and the Turkish regions. But this was not always the case for each of the regions when studied separately. For three of the regions, only data for the non-Muslims were available. These records were for Istanbul which had the best sample ABCC average of around 72, Kocaeli with 37, and for Rakka with 47. For the other seven regions, the data are available for both Muslims and non-Muslims. Non-Muslims did better than Muslims in Damascus, Mosul and Diyarbekir. In Aleppo, North Palestine, Aydin and Marash, Muslims seemed to have better ABCC results, on average (See Figure 4.10). The development of the ABCC index in these ten regions according to the birth decades of the research sample is shown in Figure (4.11). Istanbul is in the lead, as mentioned above. Its ABCC value begins at

47 for the 1780 birth decade and improves over time to reach a value of 77 for those who were born in 1810. Kocaeli, Marash, Aleppo and Damascus' results also improve with time. Diyarbekir shows only a little development for the youngest generations. Mosul's results stay stable for the whole period. Aydin's results fluctuate a lot around an average of 32. In the sample for north Palestine, values with less than 30 observations are omitted, but the rest of the results still fluctuate between the birth decades because of the small number of observations, between 37 and 106. However, Rakka's results were the most unexpected of all, with a decent number of observations that vary between 84 and 877 for the different birth decades. The sudden jump in the 1790 birth decade is brought about by the large number of the people who indicated their ages as 37 and 47 (See Figure 4.12).

4.6 Results

As shown above, the numeracy level of non-Muslims was better than that of Muslims in the Ottoman Empire during the nineteenth century. The today's Arabic regions have a lower ABCC value than the Turkish ones on average. To test whether the differences are significant or not, and to test the influence of living in a large city or on a caravan route, an OLS regression is done (See table 4.1). The dependent variable is the numeracy dummy on the individual level (1 if the person did not round his age to a multiple of five, 0 otherwise); the resulting value is multiplied with 125 to show yield an ABCC value between 0 and 100. Being Muslim or not depends on the data sources from the Ottoman Archives in Istanbul, where the Muslims were classified in separate registers to the other religions. The "Arab" variable is a dummy equal to one if the region is now located in an Arabic country and zero if it's in Turkey. The variable "large" is a dummy variable for being from a large city or not. This dummy is constructed by relying on the 1885 population statistics of the Ottoman Empire

cited in Shaw (1978). Being from a province with more than 400,000 inhabitants is considered to be densely populated and hence, a large city. The population statistics were compiled around 35 years after the last census that we consider in our research; however, it is the only available source for the total population by province in the nineteenth century. The borders and the size of the provinces would not have been the same as in the sample period, but they are assumed to have not changed considerably between these periods. The caravan routes used to cross through the Middle East, passing the main cities. The variable "caravan" is a dummy which takes the value of one if the caravan route passes through a province near a city, if not, it will take the value of zero. These values were estimated by relying on Owen (1993). The time dummies are for the birth decades and were calculated by dividing the sample to age groups and then subtracting the mean of the age group from the census year. The variable: "silk, cotton and textile" refers to whether the region raises silk worms, plants cotton or produces textiles. It takes the value of one if the region conducted any of these activities. The data for this variable stem from the Tuebingen Atlas of the Near East (Hartmann et al. 1979). The rest of the variables are dummies for the nine regions included in the research, the tenth region which is Mosul is the reference category. The first and second regression models concluded that being a Muslim has a significant negative result on the numeracy value. The same negative influence resulted from being from a country that is now Arabic. Being from a large city increased the ABCC value by around 25 points, on average. Being from a city located on a caravan route has a significant positive influence on numeracy but the effect turns negative if the dummy for the type of economic activity is added to the regression. In this case, it has a significant positive influence. The third regression model shows the effect of being from certain regions on the individuals' numeracy, taking Mosul and being born in the decade 1760 as a reference category. With

the average ABCC value being around 3.5; it seems that inhabitants of Mosul had the lowest numeracy level among the ten regions studied. All regions included differ from Mosul and have significantly better numeracy levels. Istanbul leads with 58 ABCC points, Rakka comes second, then Marash, Kocaeli, Aleppo, Damascus, Palestine and Diyarbakir which takes last place with 5 just points more than Mosul. Aydin was omitted because of collinearity.

4.7 Conclusion

We used a data set with more than 43000 ages reported by individuals who lived in different regions of the Ottoman Empire during the first half of the nineteenth century. Implementing the age heaping technique enabled us to obtain a detailed insight into the human capital development of this region. By differentiating the observations by religion, the results showed a better numeracy level for non-Muslims when compared to Muslims. In general, individuals from what are now Arabic states used to have a less numeracy than those from Turkish regions. Sizes of cities had a positive effect on its population's numeracy. Generally, the numeracy level increased with time, the economic activity dummy had a significant positive effect on it, and regions varied significantly in their numeracy levels. Thanks to the age heaping methodology, it was possible to benefit from our data and obtain a better understanding of human capital development within the Ottoman Empire during the nineteenth century.

4.8 References

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4.9 Tables

Table 4.1 OLS regression, Numeracy/ geographical/ time/ ethnic/ religion/ location

Numeracy	OLS(1)	OLS(2)	OLS(3)
Muslim	**-8.65*** **	**-8.66*** **	
	(0.000)	(0.000)	
Arab	**-9.38*** **	**-13.25*** **	
	(0.000)	(0.000)	
Large city	**25.25*** **	**28.63*** **	
	(0.000)	(0.000)	
Caravan route	**1.63***	**-2.91***	
	(0.058)	(0.074)	
Silk, Cotton, textile		**8.85*** **	
		(0.002)	
Aleppo			24.38***
			(0.000)
Damascus			21***
			(0.000)
North Palestine			17***
			(0.000)
Rakka			33.5***
			(0.000)
Istanbul			57.75***
			(0.000)
Kocaeli			29.25**
			(0.000)
Aydin			omitted
Marash			32***
			(0.000)
Diyarbekir			5.19***
			(0.000)
Time Fixed Effects	YES	YES	YES
Constant	14.50***	9.99*	3.54**
	(0.000)	(0.000)	(0.039)
Observations	26,071	26,071	26,071
R-squared	0.133	0.134	0.145

Robust P values in parentheses, *** p<0.01, ** p<0.05, * p<0.1, (1)&(2)reference category: non-Muslim, Turk, born in 1760, (3) reference category: born in 1760 from Mosul

4.10 Figures

Figure 4.1 The regions covered by our sample 1830-1851

Source: Colton, G. W. (1855). *Colton's Atlas of the World*.

Figure 4.2 Age heaping in the Ottoman states in percentage 1830-1851

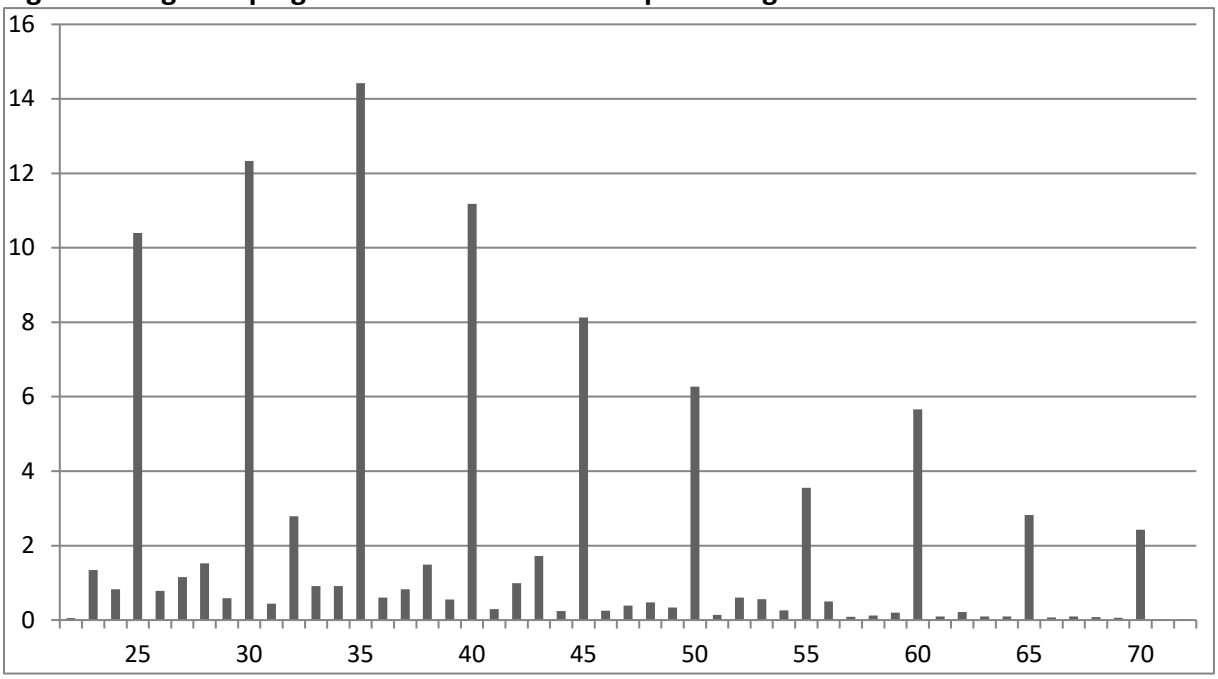


Figure 4.3 Age heaping in percentage, Turkish and Arabic states 1830-1851

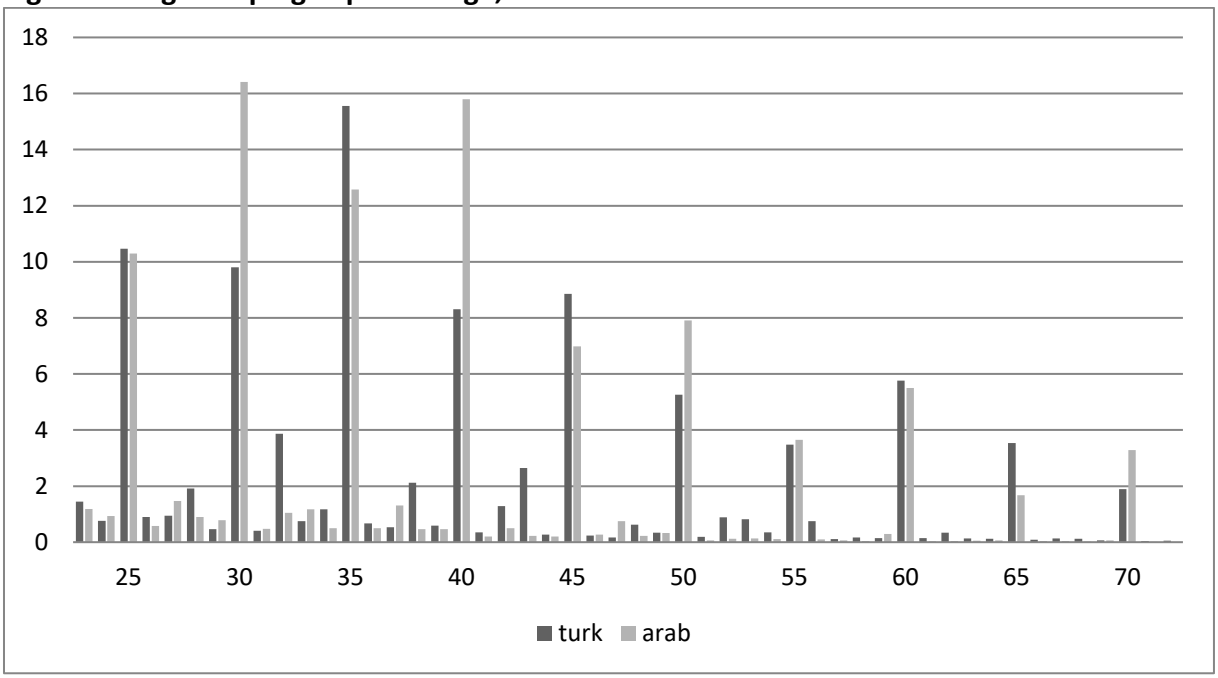


Figure 4.4 Age heaping in the whole sample in percentage by religion

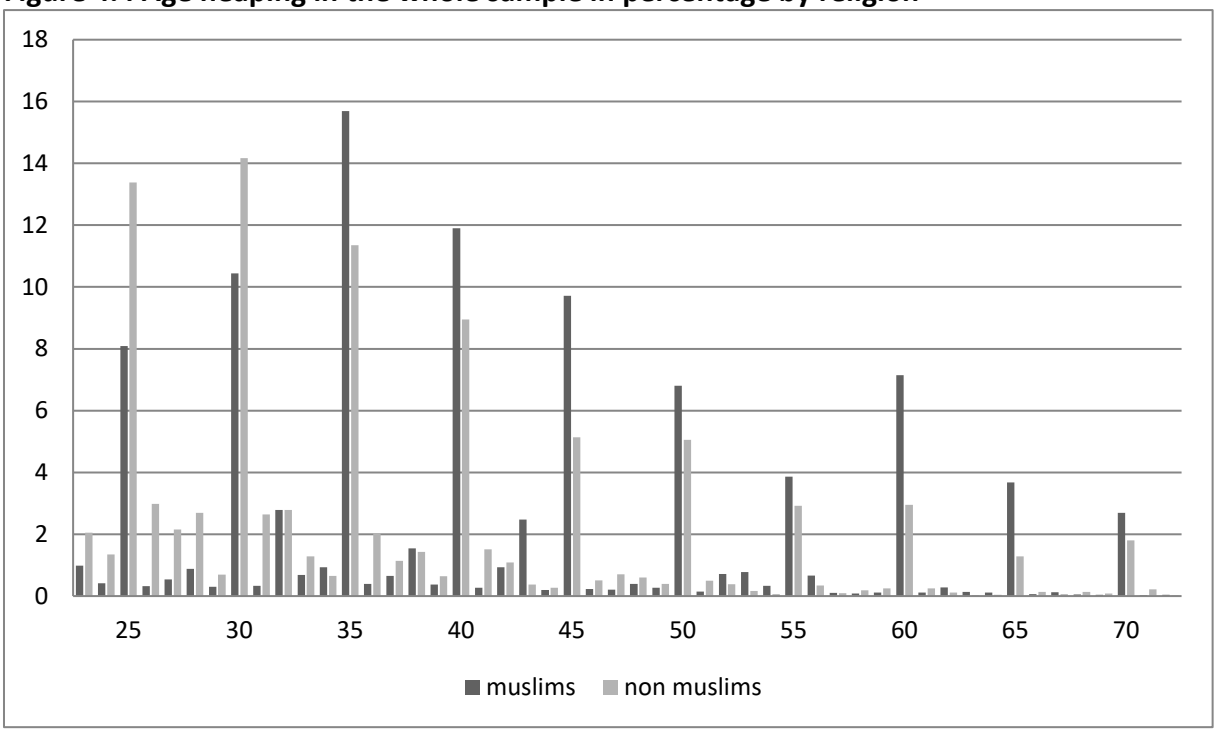


Figure 4.5 Average ABCC for Turkish and Arabic states by religion

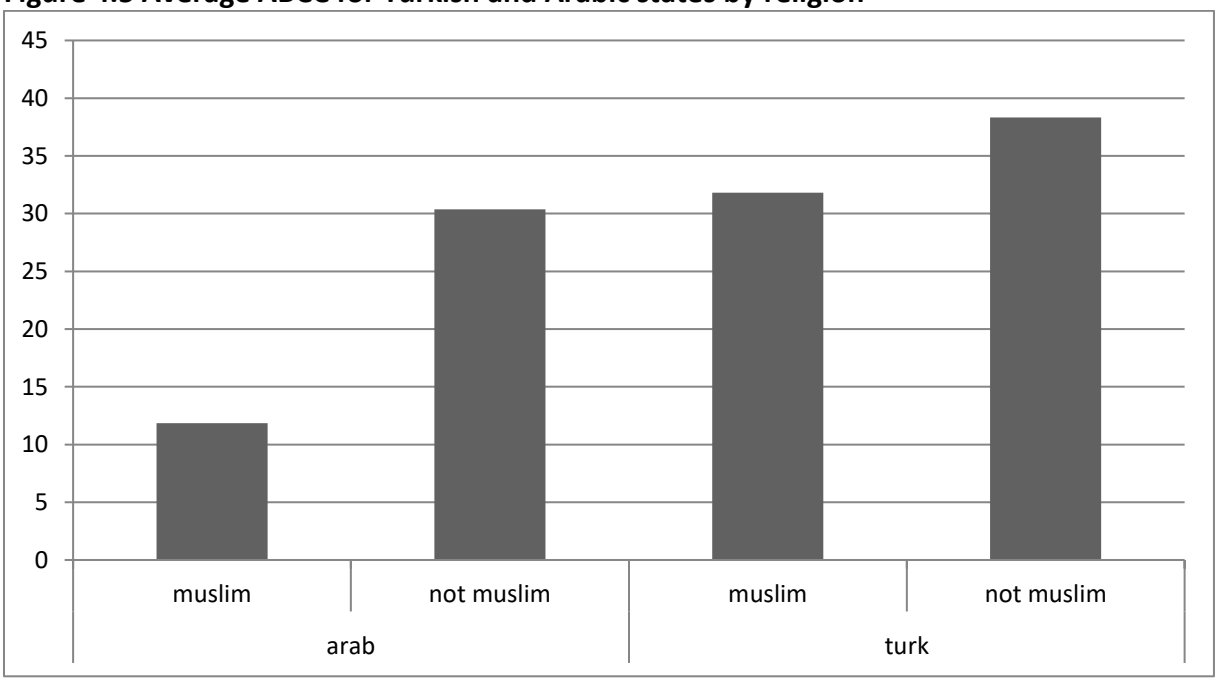


Figure 4.6 ABCC development of the Turkish and Arabic states

Figure 4.7 ABCC development by religion

Figure 4.8 Number of observations for each birth decades by religion

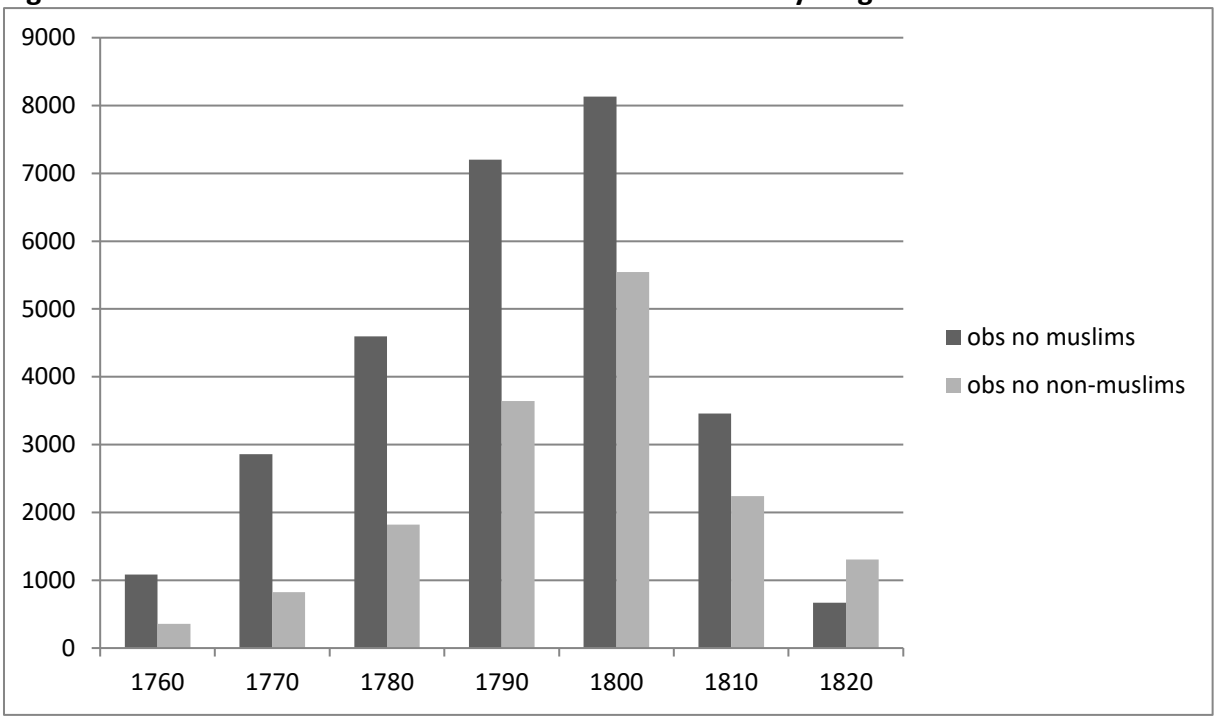


Figure 4.9 ABCC development by religion for Turkish and Arabic states

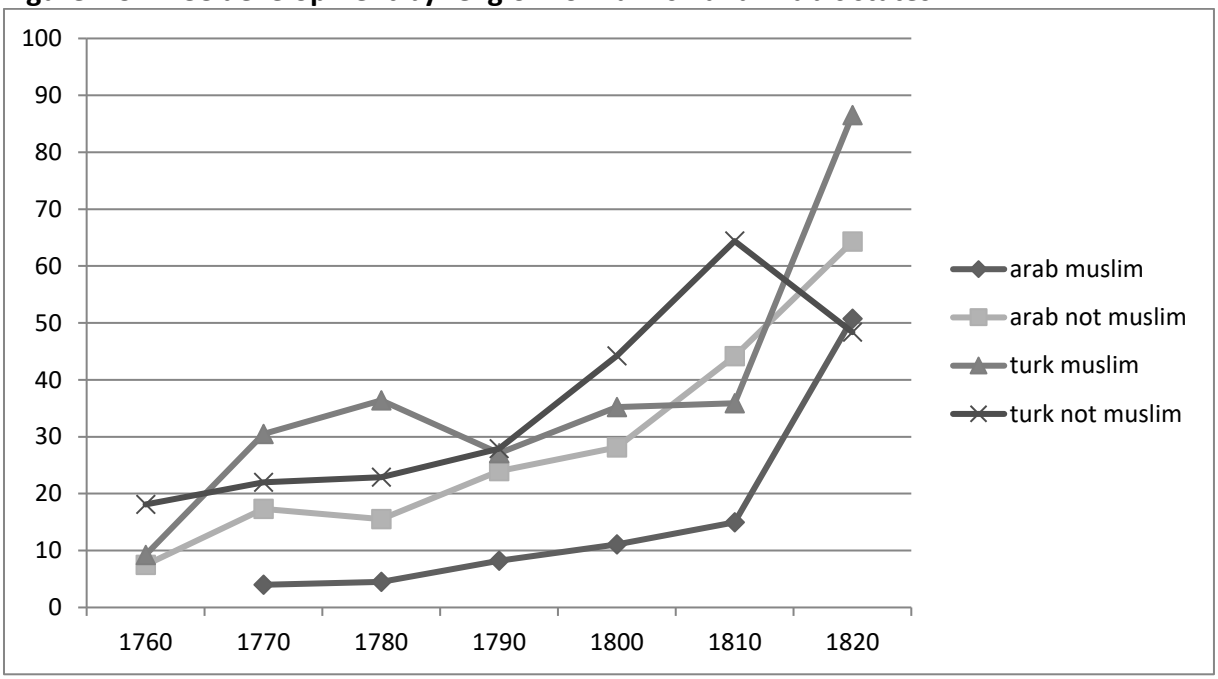


Figure 4.10 Average ABCC by religion and region

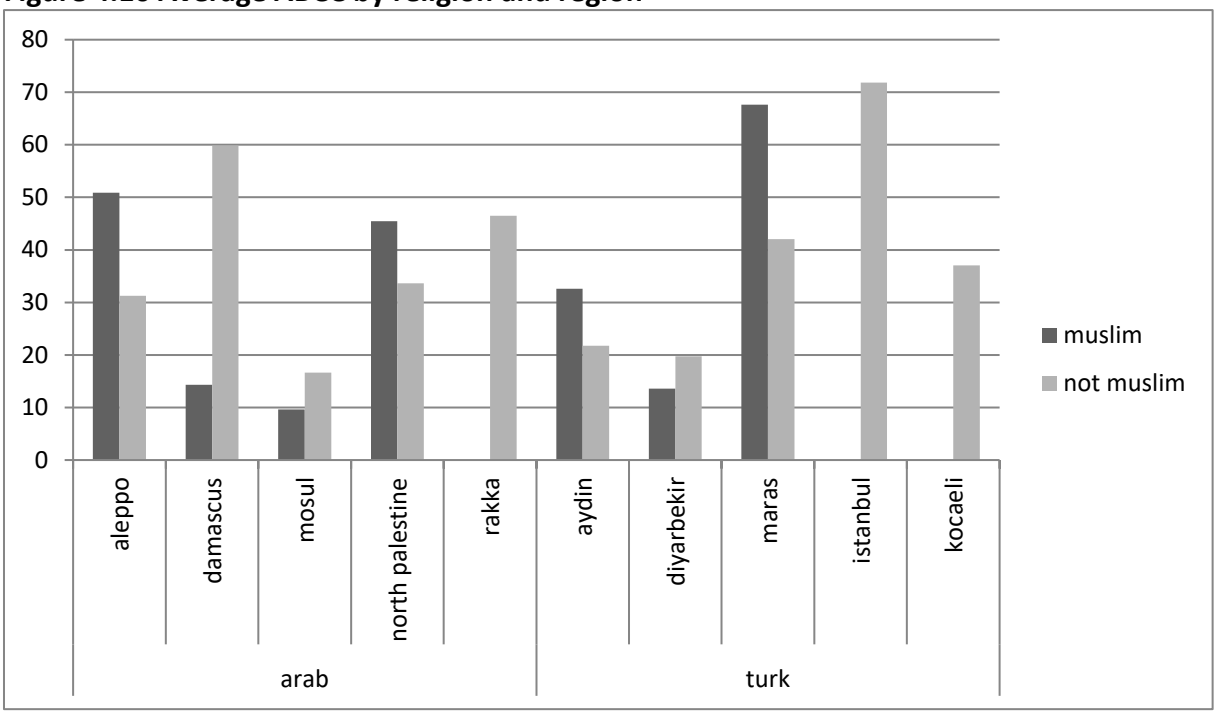


Figure 4.11 ABCC development by region

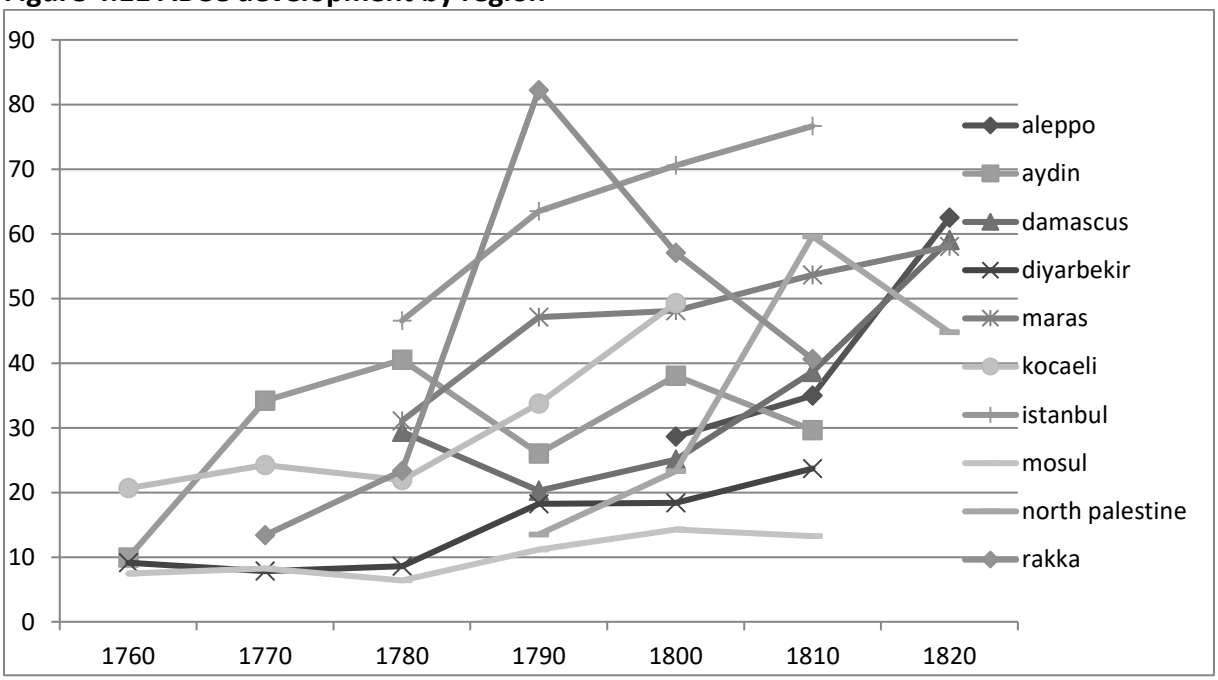
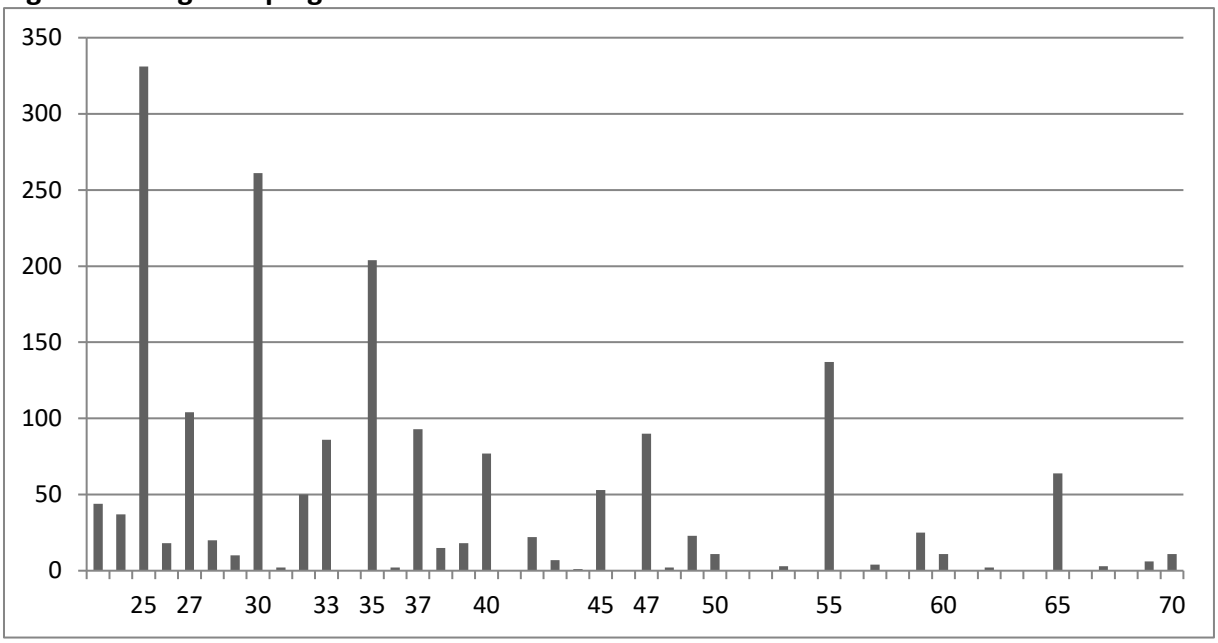


Figure 4.12 Age heaping in Rakka 1837



5. Human Capital Development: Is Secularism a Solution? Evidence from Turkey in the 19th and 20th Centuries

Abstract

Human capital and its relation to religion is an important topic, especially in the Middle East. This paper tests the influence of separating religion and government on human capital in Turkey. It also tests whether the impact was similar for all of the Turkish provinces regardless of the ethnic differences between them. The development of human capital is based on a numeracy analysis which is calculated using evidence based on two Turkish censuses which were carried out in the twentieth century. Was secularism the solution to develop human capital in Turkey? And did the secular reforms influence all the regions in Turkey equally regardless of their population ethnicities?

5.1 Introduction

The relationship between religion and human capital is thoroughly discussed in earlier studies. Some researchers showed a positive relation between religion and education. For example, Becker and Woessmann (2009) showed that Protestantism led to better education levels in Prussia. Other researchers found a negative influence of religion, such as in the United States of America, where the secular population had a higher level of scientific literacy than religious and fundamentalist Americans (Sherkat 2011).

In the first half of the twentieth century, Turkey converted into a secular state. And Ataturk, who was the leader of the country back then, replaced religious education with a national education system. The main hypothesis of this research is that separating religion from the government had a positive influence on the human capital in Turkey.

The "age heaping method" of estimating skills in numeracy by calculating the share of the population able to declare their exact ages is applied in this paper. The data stem from Turkish censuses in the twentieth century and cover the birth decades of the 1860s - 1950s. The Turkish numeracy growth rate during and after the Ataturk reforms period will be compared to other countries' growth rates in the region, and the influence of these reforms will be tested on the different Turkish provinces that differ in their population's ethnic composition.

5.2 Historical Background

Before the establishment of modern Turkey, the Ottoman Empire was ruled by Islamic law which controlled the education system (Rankin and Aytaç 2006). A year after Turkey was announced as a republic state in 1923, the caliphate system was abolished (Cagapati 2006) and Turkey converted into a secular state. Ataturk introduced reforms into different fields and education was one of them. The Islamic education system was replaced with a western education style (Koc et al. 2007), primary education became mandatory for all children - including girls (Rankin and Aytaç 2006) - and the school curriculum was developed (Gözütök 2003).

The main question is: Was secularism beneficial for human capital development in Turkey? In order to answer this question, we will study the development of an indicator of human capital during the secularization period, and compare Turkey to other countries to motivate the significant positive effect of secularism on human capital development.

5.3 Data Description

Two main data sets are used in this study. One of them is an international comparative data set on Turkey and its neighboring countries. This set contains ABCC index values for each birth decade from 1860 until 1950 for twelve neighboring countries, and was provided by Crayen and Baten (2010). The second data set is based on a combination of two different Turkish censuses. The first census was carried out in 1935. There are microfilm copies available at the Mannheim Center for European Social Research (MZES). This census includes aggregated data of the numbers of Turkish males and females for each age in 57 Turkish provinces in 1935. After digitizing the data, the ABCC value was calculated for each of the provinces and for the seven regions that contain these provinces. The second census was conducted in 1985 and it is available online from the IPUMS International database. It contains data on the individual level, such as the age, gender and location. The estimated Kurdish population share in Turkey is taken from a study by Multu (1996), and the values of GDP per capita for Turkey and the other twelve countries were taken from the Maddison Project Database by Bolt and van Zanden (2013).

5.4 Methodology

5.4.1 Age Heaping

There are many indicators used to measure human capital in a country. For Turkey, however, there is no available evidence for school enrollment before the first cohort which benefited from Ataturk's reforms (Lindert 2004). For the other Middle Eastern countries that are taken as comparison sample here, only some sketchy evidence is available. Therefore, the numeracy level of the individuals will be used in this research. Numeracy can be estimated by considering the ability of people to calculate their ages accurately. This measure can be

determined by using registers where the people reported their ages. People in the earlier times mostly reported their ages as numbers ending with zero or five. This tendency to report ages ending with a particular digit is called age heaping. Earlier literature shows a positive correlation between the age heaping and illiteracy.

5.4.2 ABCC Index

According to A'Hearn, Baten and Crayen (2009), the best way to calculate the ratio between the heaped ages in a census and the other ones is by using the Whipple Index.

$$Wh = \left[\frac{\sum (age\ 25 + age\ 30 + \cdots + age\ 70)}{1/5 \sum (age\ 23 + age\ 24 + age\ 25 + \cdots + age\ 72)}\right] \times 100$$

The result of *Wh* = 500 means that all of the people reported rounded ages. The other way around, when all people report their exact ages, the Whipple Index should be equal to 100. That means, twenty per cent of the people reported ages ending with a multiple of five, which is supposed to be the ideal case.

A'Hearn et al. (2009) suggested a new index to simplify the interpretation of age heaping. We call it the ABCC Index[23], which is a linear transformation of the Whipple Index. It estimates the ratio of the people who stated their exact ages to the whole population.

$$ABCC = \left[1 - \frac{(Wh - 100)}{400}\right] \times 100\ if\ Wh \geq 100\ ;\ else\ ABCC = 100$$

The ideal case of *Wh* =100 leads to the result of ABCC = 100, which means that all of the people reported their ages correctly. The worst case will be when everyone reports rounded ages and the resulting ABCC will, in this case, equal zero.

[23] The name of this index comes from the initials of the authors' names in addition to Gregory Clark's, who gave this suggestion in a comment on the paper

According to A'Hearn et al. (2009), in order to calculate the ABCC index, ages are divided into groups according to their birth decades. The range of the ages is between 23 and 72 and is divided into five age groups, each including ten years. The resulting age groups are classified into five birth decades and then the ABCC index can be estimated for each birth decade.

5.5 Analysis

5.5.1 Age Heaping and ABCC Index for Turkey

The available data for Turkey indicate clear age heaping in 1935, which decreases by 1985. Figure 5.1 shows the development of the ABCC index by birth decade for each region. There is a big difference between the regions which becomes less prominent for the younger generations that benefited from Ataturk's reforms, but the ranking of the regions stays almost the same. There was also a difference between the provinces. In 1935, most of the provinces in the west had a better ABCC level than the eastern provinces (see Figure 5.2). Istanbul had the highest ABCC value in the whole country with a value of around 84, which indicates higher numeracy skills for its inhabitants who were not only from various religious backgrounds, but many of whom would also have been from different regions in Turkey and moved to the big city to work there. The other provinces in the west also have a high numeracy level but the index drops to less than 35 in Gümüşhane and Ağrı in the East. These ABCC values improve to lie between 90 and 93 for most of the western provinces in 1985, but the eastern part still lagged behind with an ABCC value of around 70 in most of the provinces (see Figure 5.3).

5.5.2 Effect of Kurdish ethnicity and other factors

The eastern part of Turkey is mainly inhabited by the Kurds, an ethnic group, mostly composed of Muslims who speak Kurdish (Multu 1996). It is not easy to estimate the exact number of Kurds in Turkey. Koc et al. (2008) mentioned that in 1965, 82 per cent of Kurds lived in the eastern part of Turkey. Figure 5.4 shows the distribution of Kurds in Turkey according to the 1927 census. Multu (1996) estimated the number of Kurds in 1990; we used these estimates to calculate the effect of being a province with a Kurdish majority on the numeracy level.

Table 5.1 shows the results of OLS regressions. The dependent variable is the ABCC value on the province level. The reference category is females who were born in the 1860 birth decade. In the regression model (1), the Kurds variable is included as a dummy which equals one if the majority of the province's inhabitants are Kurds. The result indicates a significant negative effect; the numeracy level of the Kurdish regions was lower than the in those with a majority Turkish population. Males have a significantly higher numeracy level than females, and the regions with a higher share of non-Muslims had a higher ABCC level as well. In model (2), we include the Kurdish share in each province. The results stay significant and positive for the share of non-Muslims in the province and negative for the Kurdish share variable indicating that the provinces with a higher share of non-Muslims had a higher numeracy while those with a of Kurdish majority had lower numeracy. In models (3-5), we include Geographical dummy variables. The Aegean region is the reference category. The regression results stay significant and negative for the Kurdish share and the Kurd dummy variable, but not significant for the non-Muslim share in models (3&4). The Marmara and Aegean regions in the West enjoyed the highest level of numeracy when we control for time, gender, religion and ethnicity. The Eastern regions did not show a significantly lower level in

model (3), but after excluding the Kurds dummy in the regression, the Eastern and Southern Anatolian regions -which have a majority Kurdish population- show significant negative effects. The 1990 Kurdish population share is included in the fifth specification, leading to a significant negative effect. The non-Muslim share and being male still have a positive significant influence on the ABCC index in model (5). In the five models of table 5.1, time fixed effects are controlled for by adding dummy variables for the birth decades between 1870 and 1950. The birth decades show a significant positive effect on the ABCC level over time. The later the people were born, the higher their numeracy level was.

Critics mention that the government invested little to develop the Kurdish provinces (Mango 1999) and as shown above, the Kurdish regions had lower numeracy levels than the Turkish ones. In the same paper, Mango states that there was resistance against the land reforms from Kurdish landowners while other scholars criticize Ataturk's policy of ignoring the non-Turkish ethnic groups. Aytürk (2011) mentioned that using the Kurdish language was banned in public. That might have resulted in less benefit from the educational reforms because only Turkish was allowed at school, and thus the children whose mother language was not Turkish might have not understood the instruction they received at school and could not, therefore, have a similar numeracy level to the Turkish children.

Another factor which might play a role is religion. The Non-Muslim share per thousand (1935 census) is included and it shows a small but a significant positive effect on numeracy. This might indicate a better educational efficiency of non-Muslims, especially if they received more motivation to learn at home and in their communities.

5.5.3 Ataturk Reforms and Numeracy

In order to test the effects of the Ataturk reforms, we compiled a sample of numeracy growth rates for the Ataturk period, for Turkey before the reforms and for a set of twelve neighboring countries starting in the 1860s and running until mid-twentieth century based on the compilations in Crayen and Baten (2010). Then, we assigned a dummy variable to Turkey in the decades in which the Ataturk reforms should have exerted an influence on the growth rates of education of the population in general (1910, 1920 and 1930). Of course, we need to control for initial levels of numeracy: a country with a low ABCC would have more "room" for a substantial increase. In contrast, a country which has already reached a high ABCC can achieve only small growth rates. Therefore, we included only those countries which had lower numeracy values than 95 per cent.

The results indicate that Ataturk's reforms had, in fact, a significant and positive impact on the numeracy growth of Turkey, if the initial level is controlled for (Table 5.2). Clustered standard errors are used to avoid potential consequences of serial correlation. In order to capture the countries differences, we include country specific trends of numeracy growth in each of the studied models. The impact of Ataturk's reforms stays significant and positive after we include this variable.

We also controlled for other potential causes. Given the fact that some of these variables have missing values for some of the countries, we entered these controls separately, and not in one comprehensive model (including all of them at once would reduce N to 13).

(1) We include GDP per capita because the growth rate might depend on available financial resources.

(2) We control for early land inequality using Juif and Baten's (2013) estimates.

(3) Democracy: if the voter participation rate is higher, voters might demand a higher growth rate of educational investment.

(4) Finally, a high level of fertility might reduce the propensity to invest in numeracy, as the quality-quantity trade-off might lead to lower investments in larger families.

The control variables never reach statistical significance, which might be caused by the small number of cases. However, the Ataturk reforms remain significant in all models tested.

Except for the significant negative influence of fertility on the numeracy growth rate, the control variables seem to have no significant influence on numeracy (See Table 5.3).

Endogeneity is always potentially a problem. Although it is possible to control for other explanatory variables that could influence the numeracy growth rate, we believe that any omitted variables are uncorrelated to the mean of the unobserved factors that end up in the error term of our OLS regressions. World War I and the abolition of the Ottoman Sultanate are all exogenous events that might have motivated the educational reforms and Ataturk's rigor in realizing them. This would be another important argument that direction of causality is not a problem here.

5.5.4 Ataturk Reforms and the Kurds

In order to test whether the Ataturk reforms had the same positive influence on the provinces that had a higher share of Kurds, we run a new regression (Table 5.4). In model (1) we run a regression to test the influence of Ataturk reforms on the provinces that have a Kurdish share of more than 10%. In model (2), only the provinces with less than a 10% share of Kurds are included. We also control for initial numeracy in order to capture the differences between the provinces that already have a high ABCC value and do not have the same opportunity to increase their ABCC level like other provinces with lower numeracy

levels. We concluded that the effect of the Ataturk reforms remained positive and significant in the non-Kurdish provinces, but that significance disappeared and the coefficient turned even negative in the predominantly Kurdish ones.

This shows that the Kurdish regions did not benefit from the Ataturk reforms in terms of increasing their numeracy levels like in the regions with a lower Kurdish population share. The reason might be language difficulties when the Kurdish children learn mathematics using the Turkish language. It might also lie behind the reluctance of Kurdish land owners to the reforms. They may have refused to let their agricultural laborers benefit from them in order to keep the population in their agricultural occupations and easy to control politically, as Mango (1999) suggested. Finally, another reason also might be, as Mango assumed, that Kurdish regions were discriminated against and did not enjoy the same application of reforms as the other provinces.

5.6 Conclusion

This empirical analysis of the available data for Turkey in the twentieth century compared to the neighboring countries showed that secularism helped to improve human capital. The reforms of Ataturk and the separation of government and religious powers led to a significant improvement in human capital. However, the effect was not the same for all Turkish regions. The eastern part of Turkey, where the Kurds are mostly located, never fully caught up to the west. Religion also seems to have had an influence on human capital since non-Muslims showed higher ABCC values. Gender played a role in determining numerical skills as well. Even though girls were allowed to go to school, they still did not fully benefit from the reforms as much as boys did.

This research contributed to understanding the relationship between secularism and human capital, especially for the Middle East where, in most countries, religion still controls government. However, further research would still be useful in motivating the determinants of human capital development in the Middle East.

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5.8 Data Sources:

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5.9 Tables

Table 5.1 OLS Regressions of the numeracy on the provincial level

	(1)	*(2)*	*(3)*	*(4)*	*(5)*
	OLS	OLS	OLS	OLS	OLS
Dep. Variable	ABCC	ABCC	ABCC	ABCC	ABCC
Male	**22.97*** **	**22.97*** **	**22.97*** **	**22.97*** **	**22.97*** **
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Nonmuslims' share	**0.26*** **	**0.32*** **	0.065	0.063	**0.075***
	(0.000)	(0.000)	(0.101)	(0.124)	(0.066)
Kurds' Dummy	**-16.76*** **		**-19.65*** **		
	(0.000)		(0.000)		
Kurds' Share (1990)		**-0.29*** **			**-0.11*** **
		(0.000)			(0.000)
Black Sea			-11.71***	-11.72***	-11.9***
			(0.000)	(0.000)	(0.000)
Central Anatolia			-10.63***	-10.64***	-10.4***
			(0.000)	(0.000)	(0.000)
Eastern Anatolia			-1.85	**-21.51*** **	**-17.02*** **
			(0.486)	(0.000)	(0.000)
Marmara			**2.95*** **	**2.96** **	**2.92** **
			(0.009)	(0.011)	(0.012)
Mediterranean			-2.78**	-6.06***	-5.61***
			(0.032)	(0.000)	(0.000)
Southern Anatolia			-4.32	**-23.97*** **	**-18*** **
			(0.113)	(0.000)	(0.000)
Time Fixed Effects	YES	YES	YES	YES	YES
Constant	27.6***	27.06***	34.1***	34.11***	34.35***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	1140	1140	1140	1140	1140
R-squared	0.807	0.792	0.848	0.839	0.842

(Reference category: females, Aegean Region, birth decade 1860. *, **, *** denote significance at the 10, 5, 1 per cent level, respectively. P-Values are in between brackets).
For the descriptive information see table (5.5) in the appendix

Table 5.2 Determinants of numeracy growth, 1860-1950 in Turkey & 12 neighboring countries

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*
Estimation	OLS	OLS	FE	RE	RE	RE	RE	RE
Included		ABCC<95			GDP/c	Land ineq.	Democracy	Fertility
Ataturk reforms	**0.026*** **	**0.022** **	**0.067** **	**0.026*** **	**0.061*** **	**0.032*** **	**0.041*** **	**0.026** **
	(0.000)	(0.010)	(0.038)	(0.000)	(0.000)	(0.000)	(0.000)	(0.020)
Initial	-0.002***	-0.002***	-0.004**	-0.002***	-0.001***	-0.002***	-0.002***	-0.002***
	(0.000)	(0.001)	(0.047)	(0.000)	(0.007)	(0.004)	(0.000)	(0.000)
GDP/c					0.000			
					(0.298)			
Land-gini 1890						0.081		
						(0.717)		
Democracy							0.002	
							(0.148)	
Fertility								0.001
								(0.755)
Constant	0.245***	0.238***	0.396**	0.245***	0.036	0.156	0.218***	0.214***
	(0.000)	(0.000)	(0.021)	(0.000)	(0.769)	(0.358)	(0.000)	(0.000)
Observations	65	40	65	65	25	32	33	37
Adj. R-sq	0.16	0.050	0.053	0.93	0.42	0.96	0.62	0.98

(In Column 4-8, the Rsq- between is reported, *, **, *** denote significance at the 10, 5, 1 per cent level, respectively, P-Values are in brackets).
Descriptive information are registered in Table 5.6 in the appendix

Table 5.3 Determinants of numeracy growth, 1860-1950 in Turkey & 12 neighboring countries including country-specific trends

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*
Estimation	OLS	OLS	FE	RE	RE	RE	RE	RE
Included		ABCC<95			GDP/c	Land Inequality	Democracy	Fertility
Ataturk reforms	**0.016*** **	**0.024*** **	**0.058** **	**0.016*** **	**0.045*** **	**0.024*** **	**0.027*** **	**0.034*** **
	(0.000)	(0.000)	(0.013)	(0.000)	(0.000)	(0.001)	(0.000)	(0.005)
Initial	-0.000**	-0.001**	-0.002*	-0.000**	0.000	-0.001	-0.001***	-0.001**
	(0.029)	(0.032)	(0.099)	(0.013)	(0.573)	(0.239)	(0.000)	(0.013)
GDP/c					-0.000			
					(0.968)			
Land- gini 1890						-0.315		
						(0.300)		
Democracy							0.002	
							(0.176)	
Fertility								-0.008*
								(0.092)
Country-specific trends	0.970***	0.979***	0.970***	0.970***	1.067***	0.992***	0.565***	0.987***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.024**	0.034*	0.181*	0.024**	-0.075	0.250	0.109***	0.071**
	(0.050)	(0.076)	(0.096)	(0.029)	(0.179)	(0.284)	(0.000)	(0.028)
Observations	65	40	65	65	25	32	33	37
Adj. R-sq	0.725	0.702	0.701	0.998	0.076	0.977	0.946	0.991

(In Column 4-8, the Rsq- between is reported, *, **, *** denote significance at the 10, 5, 1 per cent level, respectively, P-Values are in brackets).

Table 5.4 The effect of Ataturk reform in the provinces of Turkey

	(1)	*(2)*
Kurdish share	>=10	<10
Ataturk reforms	-0.032	**0.059*** **
	(0.439)	(0.000)
Initial	-0.005***	-0.004***
	(0.000)	(0.000)
Constant	0.399***	0.323***
	(0.000)	(0.000)
Time fixed effects	YES	YES
Observations	144	369
R-squared	0.63	0.692

5.10 Figures

Figure 5.1 ABCC index development according to birth decades on the regional level

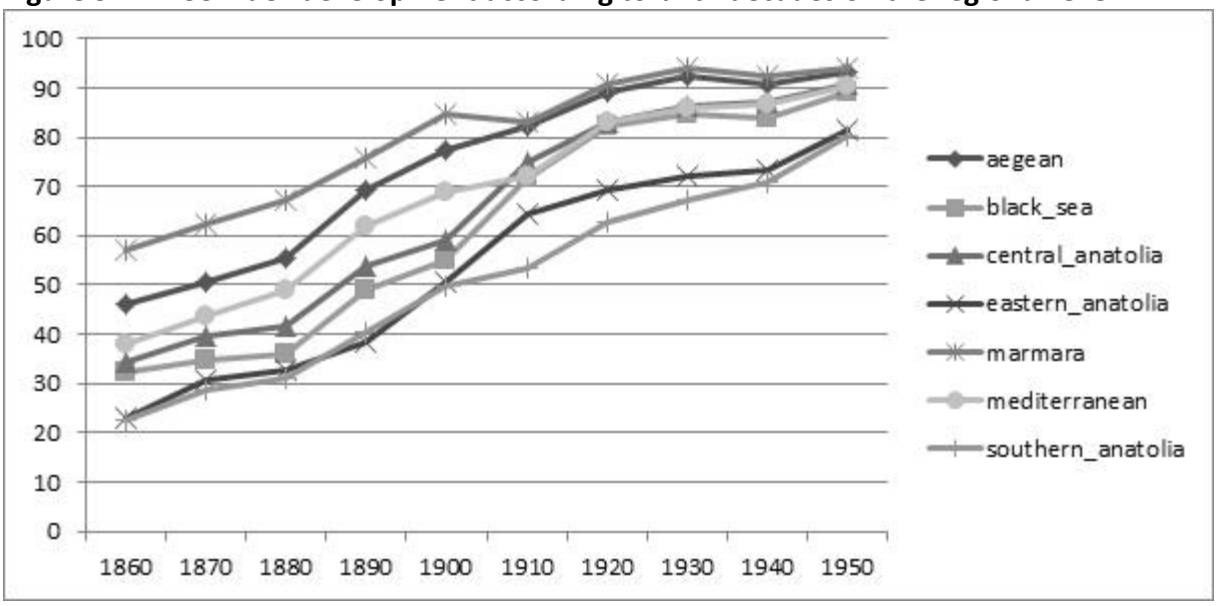


Figure 5.2 ABCC index by province 1935

Figure 5.3 ABCC index by province 1985

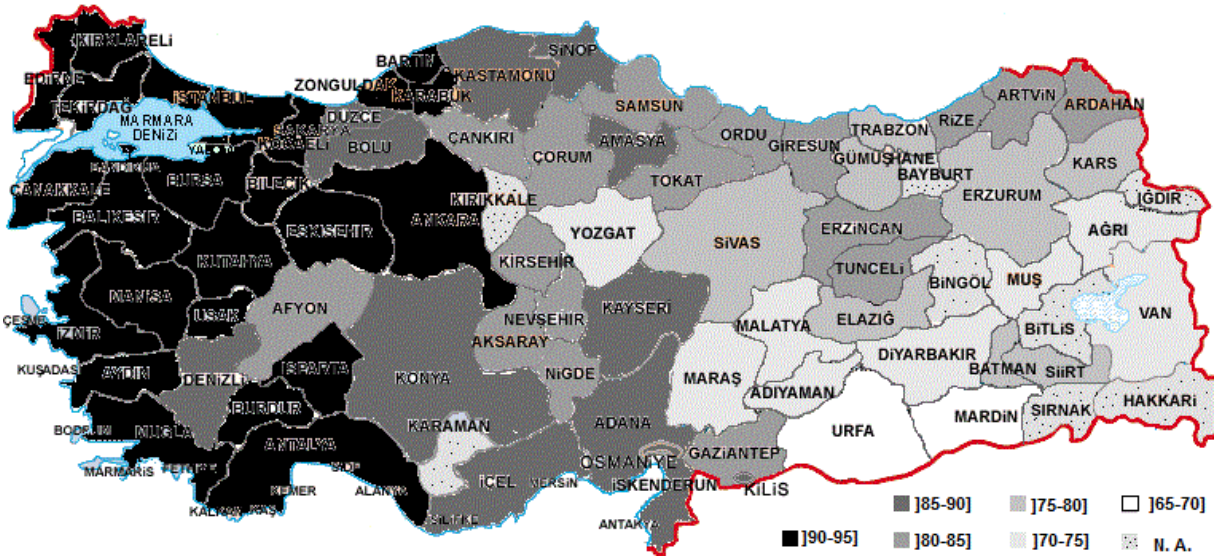
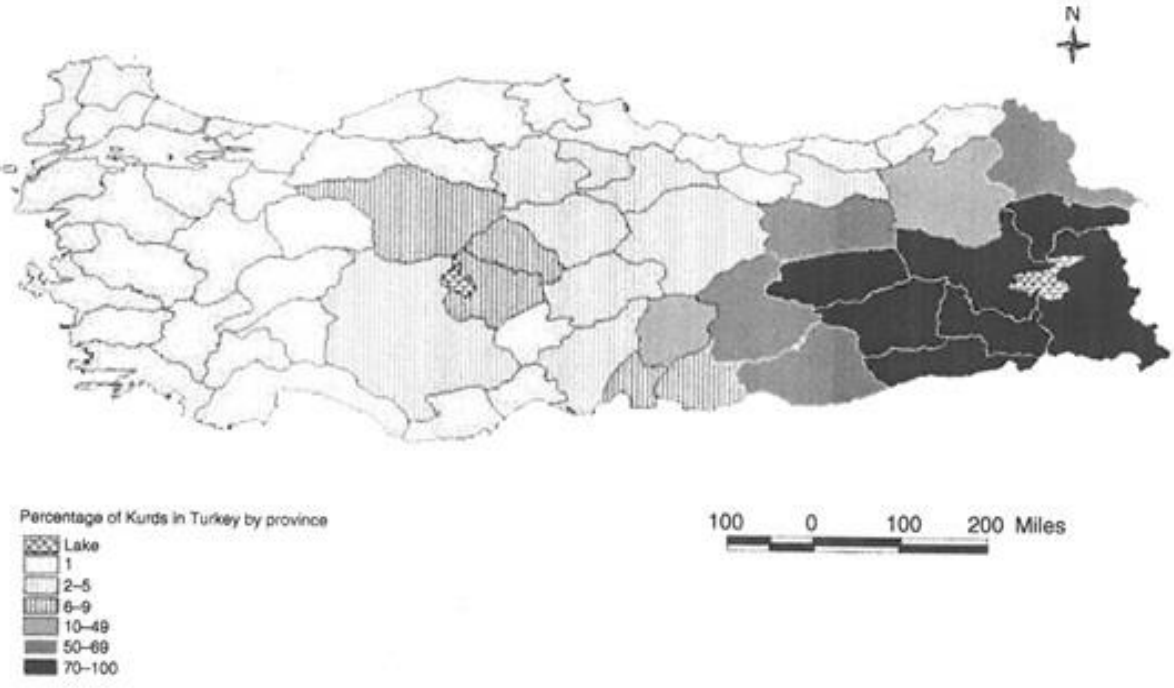


Figure 5.4 Kurds distribution in Turkey 1927



Source: Cagapati, 2006 from Büyük Atlas (1939), Data: Statistics Yearbook Vol.2 (1929)

5.11 Appendix

Table 5.5 Descriptive summary of the regressions in Table 5.1

Variable	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
ABCC	1,150	65.81	25.18	9.87	100
male dummy	1,150	0.50	0.50	0	1
Non-Muslim share	1,140	5.10	8.11	0	39.3
kurdish province dummy	1,150	0.24	0.43	0	1
kurdish share	1,140	13.65	22.93	0.02	80.09
black sea region dummy	1,150	0.23	0.42	0	1
central anatolia region dummy	1,150	0.16	0.36	0	1
east anatolia region dummy	1,150	0.14	0.35	0	1
marmara region dummy	1,150	0.16	0.36	0	1
mediterranian region dummy	1,150	0.10	0.31	0	1
southern anatolia region dummy	1,150	0.09	0.28	0	1
birth decade 1870 dummy	1,150	0.10	0.30	0	1
birth decade 1880 dummy	1,150	0.10	0.30	0	1
birth decade 1890 dummy	1,150	0.10	0.30	0	1
birth decade 1900 dummy	1,150	0.10	0.30	0	1
birth decade 1910 dummy	1,150	0.10	0.30	0	1
birth decade 1920 dummy	1,150	0.10	0.30	0	1
birth decade 1930 dummy	1,150	0.10	0.30	0	1
birth decade 1940 dummy	1,150	0.10	0.30	0	1
birth decade 1950 dummy	1,150	0.10	0.30	0	1

Table 5.6 Descriptive summary of regressions in Table 5.2

Variable	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
ABCC growthrate	65	0.07	0.14	-.49	.57
ataturk reforms dummy	130	0.02	0.15	0	1
initial ABCC	79	76.42	24.77	8.86	101.32
gdp/pc	44	1360.30	516.44	649	3027
landgini 1890	60	0.58	0.09	0.47	0.73
polity2	65	-3.69	5.95	-10	10
Fertility	70	4.03	1.65	2.28	6.51

6. Numeracy in Egypt in the 19th century

Abstract

Background: There are dramatic differences in the economic status and standards of living between the world's regions. By studying the economic history and analysing the divergent indicators in these regions, we can understand the current economic status, and even predict the future of their economic status. The Middle East is an ancient region which has a rich history, and Egypt in particular has a large influence on the region. Much research has been done on Egypt, but there is still a lack of applied research based on economic indicators. Our research is based mainly on a census which was carried out in the nineteenth century and covered most of the Egyptian population back then. This sample introduces demographic indicators that can be used to gain a wider understanding of Egypt's human capital development in this period.

Method**:** Measuring human capital development could be done with the help of various indicators. In this research we will use the numeracy level as a proxy for education and human capital. The numeracy level is defined here by the ability to achieve a simple mathematical task correctly. The numerical task will be the estimation of age in our research. If a person is not able to calculate his or her own age accurately, he or she will be considered as innumerate, reflecting a low educational standard which implies a poor human capital as well. We use the age heaping method to estimate the numeracy level for Egypt in the nineteenth century. We will calculate the ABCC index on the district level to

This Chapter was written based on the census data of Egypt provided by Prof. Dr. Mohamed Saleh and his comments and instructions. The writing was 100% on my behalf. The data were 100% collected, digitized and prepared to analysis by Mohamed Saleh. The concept and analysis were developed 80% on my behalf and 20% on behalf of Mohamed Saleh

study the geographical differences. We also considered the influence of time on the numeracy level and calculated the ABCC index for seven birth decades. In addition to comparing ABCC values for the different religious groups, we also compare occupational categories and the differences between males and females. In order to see if the measured differences between those categories are significant, we run regressions on the individual level in addition to the district and province levels.

Results**:** By calculating the ABCC values, we observe an upward development over time, albeit on a low level. The younger generations benefited from the school reforms and showed a higher numeracy level than the oldest ones. The males also showed a higher numeracy level than females which reflects a certain degree of gender inequality in the educational opportunities that were available in that period of time. The numeracy level of Egypt was low in general but it was not similar in all geographical areas. Indeed, it differs between religions and occupational groups as well. As expected, educated people showed a higher numeracy level. On the other hand, the farmers who might not have had a proper education enjoyed a high numeracy level as well. The regressions that we run emphasised a high degree of significance among these results.

Conclusion**:** Applying the age heaping methodology helped to understand the development of human capital in Egypt during the nineteenth century by examining the development of numeracy. Measuring the numeracy rates of the Egyptian people according to their occupation, gender, birth decade and place of residence explained much of the education level within these categories in the studied period.

6.1 Introduction

The main research goal is to examine human capital development in Egypt in the nineteenth century. To achieve this goal, we study the development of numeracy by using a large sample of census data and apply the age heaping method to our dataset in order to answer certain essential research questions. These questions are: Did the numeracy level of Egypt improve after the onset of reforms that occurred during the reign of Muhammad Ali in the 19th century? Was the development of numeracy similar for all of the regions in Egypt? Were there significant differences between the numeracy levels of Muslims and Copts? Did the high skilled and professional population enjoy higher numeracy levels than the farmers and the unskilled population? And finally, how was the development of gender inequality during that period? These questions were answered after measuring numeracy by calculating the ABCC index.

6.2 Data Description

In this research we use a distinctive data set which stems from two nationally-representative individual-level samples of Egypt's 1848 and 1868 population censuses that were digitized at the National Archives of Egypt in Cairo (Saleh, 2013). The samples consist of more than 166,000 observations; around 58% of which are from the 1848 census. The two censuses contain a variety of variables that characterize economic, religious and demographic distribution in the nineteenth century. The population in these two censuses was documented in great detail, revealing the full name of each individual, their gender, age, religion, occupation, ethnicity, place of residence and district of birth. In addition, more detailed information is included on the quarter in which they lived, their legal status (slave/ free) and any infirmities. The 1848 census was the first countrywide census, and was not

repeated until 1882 (Cuno and Reimer 1997). However, the second census of 1868 still covered a large area of Egypt including all major cities and villages and our sample covers seven out of the seventeen provinces covered in the 1848 census.

We decided to drop the slaves and the non-Egyptians as a separate analysis of them is planned. We include the birth years between 1776 and 1845. For the following analysis, we needed to restrict the data set to the age groups 23-72. This is the standard for the age-heaping numeracy literature that aims at avoiding biases (See below: "Method"). As a result, the sample size shrinks to ca. 48,000 individuals, 88% of which were Muslims, 9% Christians who were mainly Copts, around 0.8% were Jewish and the rest were recorded as unknown or as other non-Muslims. For Alexandria and Cairo, the ages of women were only reported in aggregate categories that we cannot use for age-heaping. Roughly half the sample outside of Alexandria and Cairo consisted of females, but given their weight in the sample, in the final data set around 72% of the individuals were males. These males worked in more than 250 different occupations. The occupations were recorded for 30,000 men, around 38% of them were classified as skilled laborers (mostly craftsmen), 29% were unskilled laborers and workers, 17% were professionals and white-collared workers while 17% of them were farmers (See Figure 6.1).

The geographical regions were accurately specified by the place of birth and residence; not only were the provinces and the smaller districts documented in the registers, but also the town quarters and street names. More than 1,300 quarters were distributed between more than 100 districts. 17 different provinces could be included in the analysis. The metropolitan areas of Cairo (29%) and Alexandria (20%) were oversampled because the economic development of the various economic groups in these cities is particularly revealing. On the other hand, we want to estimate a nationally representative sample, so we

apply weights that give more prominence to the agricultural provinces. We also apply weights to make the results representative for both genders.

6.3 Age heaping methodology

Human capital is one of the main drivers for economic development, the other kinds of capital are important but they will not be useful without sufficient human capital. It is not easy to define human capital precisely like the money, stocks, land and equipment because it is not possible to separate this kind of capital from the population (Becker 1975). This concept, however, refers to the knowledge, skills, health, values and intellectual abilities of human beings. All kinds of investments in knowledge and health can lead to the human capital development. In order to examine the human capital development of a population, we can study the development of different indicators through the studied period. Some examples of human capital indicators could be the literacy rate, the higher education graduates rate, school attendance and government expenditure on health and education. If we do not have the necessary data to calculate one of these measures, we can use other measures as a proxy. For example, if we do not have literacy rates, we can use the signature rate as a proxy for literacy. In addition to literacy, the numeracy level is also an accepted indicator for education and it is also considered a suitable indicator for human capital. In order to determine numeracy level, we can use the age heaping method. Age heaping is used as a method to estimate the education level in a society (Mokyr 1983; A'Hearn, Baten and Crayen, 2009; Manzel and Baten 2009; Crayen and Baten 2010). The concept of age heaping refers to the phenomenon of reporting inaccurate ages when people are asked how old they are. People tend to round their ages up or down to multiples of five. The reason might be that they do not know their exact date of birth or because of low numerical skills. If

people have low educational attainment and do not enjoy good numerical skills, they might not be able to calculate their ages accurately, even if they know their birth dates; therefore, they round them to multiples of five. We will use the accuracy of determining ages as a proxy for numeracy. A negative correlation was found between the age heaping and the literacy levels (Myers 1954, Hippe and Baten 2012). We have no data about literacy rates or the other measurements of human capital in Egypt during the nineteenth century. Therefore, in this research we will use the age heaping method as a proxy for numeracy to measure human capital, because it can reflect the level of education in Egypt during that period of time. The index used to calculate the age heaping is the Whipple index, which is calculated by taking the ratio of the number of all rounded ages (multiples of five) to the expected number of rounded ages (which is the fifth of the whole studied sample).

$$Wh = \frac{\sum(n_{25} + n_{30} \ldots . + n_{70})}{\frac{1}{5}\sum(age\ 23 + age\ 24 + age\ 25 + \cdots + age\ 72)} \times 100$$

A value of 500 indicates the worst case when all the individuals report rounded ages, while a value of 100 is the best case and occurs when only the expected number of people report ages that are multiples of five, a fifth of the population. The zero case happens only when no one at all reported a rounded age. However, A'Hearn, Baten and Crayen (2009) proposed a transformation of the Whipple Index to make it easier to interpret. The new index is called the ABCC index[24] and is calculated by transforming the Whipple index to a value between zero and a hundred.

$$ABCC = \left\{1 - \frac{(W - 100)}{400}\right\} \times 100 \quad if\ W \geq 100;\ else\ ABCC = 100$$

If the Whipple index were equal to 500 when all people report rounded ages, the ABCC value will be equal to zero while, if all people reported accurate ages, the ABCC value would reach

[24] The index's name represents the Authors' initials plus Gregory Clark's who suggested the name.

one hundred. This would indicate a perfect case where all of the population can calculate their ages accurately, reflecting perfect basic numerical skills in the studied sample. We can conclude that these people all received basic education which raised their numeracy skills and enabled them to calculate their ages precisely.

6.4 Results

By applying the age heaping method we found that Egypt had a very low numeracy rate in general. In the first census of 1848, the ABCC value was 4 and it only increased to 15 in the second census, twenty years later. This reflects a poor education level in general compared to Crayen and Baten (2010). The studied sample contained the population between 23 and 72 years old. People younger than 23 years old were excluded in both of the two censuses for two reasons. The first is because children's ages were supposed to be reported by their parents, so they reflect their parents' numerical skills and not their own. The second is because younger people might still know their exact birth dates from their parents and they might have needed to report their ages on different occasions just prior to the survey, so they still can report the right ages even if they do not have high numerical skills. The oldest people, on the other hand, are excluded to avoid a potential selection bias. People who had received a better education and higher living standards are expected to enjoy a healthier and longer life. In addition, there is the tendency among the elderly to report higher ages than their real ones in order to exaggerate their life experiences. Therefore we excluded all people older than 72 years old from the sample.

We divide the studied population into five groups; each of them contains 10 years. The groups contain the people whose ages are between 23-32, 33-42, 43-52, 53-62 and 63-72 years. This division is done for both censuses resulting in seven groups of decades from

the 1780s until the 1840s. We avoid including rounded ages in the groups' bounds which makes the groups more homogenous. Each group has two multiples of five (25 and 30 for example). Former studies showed a tendency to round ages in the youngest group (age 23-32) to multiples of two. Therefore, we control for this phenomenon and adjust the ABCC index value by 25% (Crayen and Baten, 2010). As expected, the younger generations had a better numeracy level than the people born in earlier decades. In Figure 6.2, we can see the ABCC trend in Egypt for the population born between the birth decades of 1780 and 1840 for both censuses. The 1848 census has a low ABCC value of less than 4 points for all birth decades. In the 1868 census, the numeracy level increased gradually to reach 17 points for the youngest generation which was born in the 1840s. However, the data of this figure includes all of the observations for males and females who are between 23 and 72 years old. In Figure 6.2, one can also notice a shift of around 5 points for the overlapping decades in the two censuses. This increase in the overlapped decades could be caused by the data counter-checking. Therefore, we add the corrected ABCC values by deleting the average difference between the two censuses from the 1868 census in order to give an appropriate estimate of Egyptian numeracy on the national level.

Another issue is that, in the sample we have a larger number of males than females. As shown in Figure 6.3, females constitute around 28% of the total population, and this percentage is inconsistent between the provinces. Therefore, we give more weight to the females in the provinces that lack females in order to balance our results. In addition, we have no information about the occupations of most women, among other variables. Therefore, we will include only the male individuals in the occupational analysis. The females will be included only when we study gender differences, where they will be given more weight.

6.4.1 Religion:

Before the Islamic conquest of Egypt in the seventh century, Christianity was the main religion of the region. Egypt was known back then as the Land of Copts. But after the majority of the Egyptians converted to Islam, the word Copts was used to refer only to the original Christians of the country (Ibrahim 1996). In the following we will distinguish between Christians (Greek Orthodox, Catholic, Protestant and Oriental Christian Churches who were basically descendants of immigrants from Europe, Syria and other regions) and the Copts who were also Christians but were perceived as a separate group.

As mentioned above, we include only the male observations to measure the difference between the numeracy of the different religious groups and calculate their ABCC values in each census. The ABCC values differ not only between age groups and the two censuses, but also between religions. In the first census, the Christians had the highest ABCC level which was almost 25 points. The Jewish came in the second place with 12 points, Copts came in the third place with around 6 points and the Muslims, who were around 88% of the total population, did not even reach 4 points (See Figure 6.4). The ranking had changed by the second census, and Christians stayed in the first place with an ABCC value of 38, Copts had the second highest ABCC level in 1868 with around 29 points, leading the Muslims who had an ABCC value of 18 points. In stark contrast to the first census, the Jews came in last place after they increased to only 13 ABCC points. However, the number of Jewish observations in this sample is very low; not more than 380 observations in the whole dataset. The difference between the Copts and Muslims could be caused by the fact that Christians did not assimilate with the Muslim majorities because of the Greek influence on their culture, while the Islamic culture was influenced by the desert Arabs (Issawi 1963). Our results are also in line with Saleh's (2010) conclusion who found that non-Muslim minorities

enjoyed higher literacy rates compared to Muslims using village/quarter data set from censuses of the years 1897 and 1927.

6.4.2 Gender:

The religious distribution of female inhabitants was similar in both of the Muslim and the Copt categories, but our sample includes almost no Jewish or Christian females. The females that included in our sample are basically all Muslims (more than 91%) and Copts (less than 6%). They also had different ABCC values than the males in the same religion group (See Figure 6.5). The ABCC values for both males and females were low in 1848, except for Christians, all of them were less than 14 but the values for Jewish males and Copt females were almost twice as large as the values of the other groups. Even though the differences were small in the 1848 census, they increased with time. Christians kept having the highest ABCC value with around 38. The numeracy of the Copt males increased to reach a value of almost 33, the largest increase among all groups. The only group that did not show a clear increase in value in the 1868 census was Jewish males; this might an outcome of the very small sample size of Jewish males. The development was also dissimilar on the gender level. Males and females did not achieve the same increase which clearly appears when we calculate the gender gap using the equation:

$$Gender\ Gap = \ ABCC\ (male) - ABCC\ (female)$$

The higher the value of the gender gap, the larger the difference between males and females is. This indicates that males had a better numeracy level than females and refers to inequality in education opportunities between the male and female populations in that period of time. As shown in Figure 6.6, in the census of 1848, the ABCC value of all individuals was too low regardless of their religion or gender, which resulted in a very small

gender gap of less than 0.1 points for Muslims, and even a negative gap for the Copts whose women's ABCC value exceeded their men's by 3 points. However, this gender gap became greater in the second census, especially for the Copts whose males' numeracy level was more than twice their females, resulting in a gender gap of around 20 points. There was also no improvement in the Muslim gender gap. On the contrary, the difference between the ABCC values of Muslim males and females enlarged to 8 points in the second census.

6.4.3 Occupation:

As mentioned above, there was a large variety of occupations in the data set. In order to be able to study the influence of these occupations on the numeracy skills of the population, we collapsed them into four categories, the unskilled, the skilled, the professionals and the farmers. The first category contained the unskilled observations which had all kinds of jobs that did not require any level of education or training. Those jobs, such as a janitor, a café worker or a donkey owner can be practiced without previous training at all. The occupations that did need a certain degree of training before being practiced are covered in the second category: the skilled population, these were tailors, smiths, carpenters and other occupations which did not need a specific education level or certified training, but they, nevertheless, needed to have some training to get the requisite skills to practice those occupations. The third profession category includes all of the occupations that needed a formal education certificate to be practiced, such as teachers, doctors and accountants. The people who practiced those occupations were expected to have enjoyed a certain education that enabled them to collect a basic level of numerical skills leading to the highest ABCC values of all categories. The fourth category includes the farmers. They are not included as unskilled labour because they gained farming skills to be able to be farmers but they also did

not practice an occupation that can be included under skilled labour. Farmers may be illiterate but still have basic numeracy skills and a certain sense of time and age, because their work relies on the seasons. Hence, they warrant their own category. After measuring the age heaping for these four categories, the results between them were not that different in between the four categories. In 1848, the results were as expected, with the lowest level of ABCC for the unskilled workers followed by the skilled, the farmers and then the professionals who had the highest ABCC level. However, in the second census the ranking changes, though the difference in the ABCC values between the different categories do not look large. While the skilled and the unskilled workers scored a value of around 19, the professionals exceeded 20 points and the farmers held first place with 21 points (See Figure 6.7). In order to confirm that the occupation category had a significant influence on the numeracy level, as figure 6.7 shows, we run a regression to test the significance of these results.

6.4.4 Analysis:

I. On the individual level

In order to test whether the descriptive results were statistically significant, we run a set of regressions. The first regression set was run on the individual level. The dependent variable was “Numerate”, which is a dummy variable that takes the value of 0 if the person reported a rounded age and 1 otherwise. We specify a Linear Probability Model but the results are similar with Logit. The independent variables that we include in five models reflect the gender, religion and occupational group of the individuals in addition to their birth decade and the census in which they were recorded. After running the regressions, we multiply the

results with “125” to construct a value of numeracy index between 0 and 100 (See Table 6.1).

In the regression model (1) the reference category is a Coptic male born in the decade 1780, drawn from the 1848 census. The independent variables are all dummy variables which take the value of one if the variable’s name applies to the observation and zero otherwise. In this regression being female leads to a significantly lower numeracy level. While some of the male children used to go to school, the movement towards girls’ education only began after Khadeive Ismail, the grandson of Muhammad Ali, ruled the country. The first girls’ school was opened a few years after the second census in 1873 (Ali 1975), though, a school for Midwives was established to teach the women modern medicine in 1832 during the reign of Mohammed Ali. But it only contained a small number of women which did not exceed 24 student by 1863 (Fahmy 1998). Moreover, in the household sons usually were more encouraged to learn basic abilities rather than girls.

To test the influence of the different religions on the numeracy level, we included the Christian, Muslim and Jewish dummy variables with Copts being the reference group. Including the religions in this regression showed that being a Muslim had a significant negative influence on the numeracy value, but being a Jew did not make a significant difference to being a Copt. Being a non-Copt Christian, however, showed a high significant influence on the results. Numeracy rises significantly in the 1868 census but despite controlling for the census year, the value of numeracy also rose significantly rise for the people born in the 1820 decade or afterwards. This confirms that the younger generations who benefited from the reforms in Egypt in the nineteenth century enjoyed a higher numeracy level.

In the rest of the regressions of Table 6.1, we exclude females and apply the regressions to the males only. Therefore, the number of observations drops to around 34,000 individuals after being more than 47,500.

The regression model (2) shows that excluding the females from the regression and not controlling for time fixed effects does not change the significance of the results. Being a Muslim male had a significant negative influence on numeracy and Christian males still have a higher numeracy level than all other religious groups.

In the third model (3), we test the influence of the different occupation categories on the numeracy level. We also include the religious dummy variables and control for census and time fixed effects. The reference category is an unskilled Coptic person who was born in the decade 1780 and was included in the first census. This regression shows that the second census results were significantly higher than in the 1848 census. As in the regression model (2), Christian numeracy level was significantly higher than those of the Copts. On the other hand, Muslims had a significantly lower numeracy level. The later the people were born, the higher the positive influence on their numeracy. The influence of this time trend seems to have begun in 1820. The new information reported in this regression is the influence of certain occupation categories. Skilled people did not have significantly higher numeracy values than the unskilled, but the expected ordinal relationship between occupation and numeracy changes for farmers and professionals. Being a farmer or working in a professional occupation increases the numeracy of the person significantly. These results affirm our initial assumptions about the positive influence of education on the numeracy level, and vice versa. Farmers tend to enjoy greater numerical skills than their education level predicts because of the nature of their work; need a better awareness of time and seasons. They could also have benefited from the agricultural reforms that were applied to a huge area of

the region during Mohamed Ali's era (Alshalak et al. 2006). These reforms benefited farmers by distributing unused land, introducing new crops and setting up a new irrigation system.

In the last regression model (4), we include only the occupation dummy variables in addition to the census dummy variable. In this model, a skilled person has significantly better numerical skills than an unskilled person does. A farmer has a higher numeracy value than both skilled and unskilled people, and a person who belongs to the professional category will enjoy a significantly higher numeracy value.

Muhammad Ali put the farmers in direct contact with the government and introduced long-staple cotton planting to Egypt. After the European demand for Egyptian wheat declined, the country needed a new crop to increase the revenues. With the help of foreign experts between 1821 and 1822, the planting of the long-staple cotton began. This sort of cotton was widely demanded in Europe and its prices were much higher than those for the short-stapled cotton that Egypt had planted previously (Richards 1982, Rivlin 1961). The irrigation system was upgraded and new canals were constructed. This support of the agricultural sector might account for the high numeracy level of farmers.

II. On the province[25] level

To have an overview of the numeracy values by province, we calculate the ABCC index for each province in both censuses. The first census included the entire country and the data was sufficient to obtain ABCC results for 17 provinces. The 1868 census, however, covers only seven of these provinces. Figure 6.8 includes the ABCC values of the provinces (from North to South) in both years. In general, the values improved with time. The levels differed between the provinces. The highest numeracy results were in Giza, in Lower Egypt, and in Asyut and Girga in Upper Egypt. Cairo and Alexandria had middle ABCC values, while most of

[25] All the analysis is carried out on the place of residence (province or district). We need to assume that selective migration was limited.

provinces in the delta region had lower numeracy levels. These values are calculated only for the males.

In our dataset, we have a very small number of female inhabitants whose occupations were documented. The reason might be that occupations were only documented for household heads, usually men, or because of gender inequality in employment opportunities over the period. The lack of job opportunities for women in industry or craft services, the poor reputation of working in domestic services, and Mohamed Ali's movement to limit Muslim women to employment as domestics (Tucker 1985) are possible reasons for the lack of females with reported occupations. Therefore, after testing the influence of being female on human capital, we test the influence of the female/male ratio at the province level. The dependent variable in this case is the provincial ABCC value. The independent variables are the female/male ratio and the Copts' share in each province. We also control for time and census fixed effects (See Table 6.2, Model (1)). This regression confirms the significant influence of religion on the ABCC value. The provinces with a higher share of Copts showed a higher ABCC value. On the other hand, the effect of the ratio of females to males in each province was negative but not significant. Although on the individual level, being female influenced the numeracy, the higher share of females in a province did not lower its ABCC value. In this model, we also controlled for time fixed effects and census fixed effects. In the rest of the models in Table 6.2, we test the influence of occupation on the ABCC level of a province. We run a regression of the ABCC of the provinces on the share of the different occupation groups and control for census and time fixed effects. However, the share of the occupation categories is insignificant although this factor has a significant influence on the individual level. The influence of the second census and the Copts share stay positive and significant on the provincial level.

III. On the district level

In order to benefit from more disaggregated data, we calculate the ABCC values for each district to see the differences within each province. The results showed differences between the districts but most of the districts in the same province were similar to each other. The district level ABCC values are shown in Figure 6.9, which includes two maps of the Egyptian districts under study located on the Nile. One of them relies on the 1848 census and the other shows the 1868 results, which has a large area with no available data.

6.5 Conclusion

Using a large data set that stems mainly from the countrywide census of 1848 and another census twenty years later, we were able to obtain an overview of the numeracy levels in Egypt during the nineteenth century. The data set is supposed to include accurate information about the ages of Egyptians, as falsification by the administrators and the headmen of villages, who were responsible of collecting the data (Cuno and Reimer 1997), was punishable by imprisonment. Relying on these age records and using the age heaping method, we found a positive significant influence of the Coptic religion on individual numeracy as well as a significant positive effect of the Coptic population share on the province's ABCC value. Gender inequality was also significant but only on the individual level. Occupation also played a significant role on the individual level. While professionals and farmers enjoyed a high numeracy level, the skilled and the unskilled population had a lower level. On the provincial level, however, the occupation share had no significant influence. The geographical regions did not differ in their ABCC values significantly. In general, Egypt shows a low numeracy level which increased steadily with time.

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6.7 Tables

Table 6.1 Regressions on the individual level

Dep. Variable	*(1)* Numerate dummy	*(2) males only* Numerate dummy	*(3) males only* Numerate dummy	*(4) males only* Numerate dummy
Female	**-5.3*** **			
	(0.000)			
Christian	**49.5*** **	**10.3*** **	**10.3*** **	
	(0.000)	(0.000)	(0.000)	
Muslim	**-4.6*** **	**-9.1*** **	**-9.1*** **	
	(0.000)	(0.000)	(0.000)	
Jew	-1.7	-7.1	-6.8	
	(0.728)	(0.105)	(0.112)	
Skilled			-1	**4.6*** **
			(0.118)	(0.000)
Professional			**2.9*** **	**8.7*** **
			(0.000)	(0.000)
Farmer			**2.3*** **	**5.2*** **
			(0.000)	(0.000)
Time fixed effects	YES	NO	YES	NO
Census fixed effects	YES	YES	YES	YES
Constant	10.6***	12.4***	9.02***	1.7723***
	(0.000)	(0.000)	(0.000)	(0.000)
Adj R-squared	0.0681	0.0407	0.0956	0.0326
Number of obs	47,692	34,206	34,206	34,206

*** p<0.01, ** p<0.05, * p<0.1, P Values are in brackets
Note: the 1868 census is included as a dummy variable to detect systemic differences over time.
Model (1) the reference category is a male Copt born in 1780
Model (2) the reference category is a Copt drawn from the first census
Model (3) the reference category is a non-Copt born in 1780
Model (4) the reference category is an unskilled Copt born in 1780
Model (5) the reference category is an unskilled person drawn from the first census

Table 6.2 OLS regressions on the provincial level

	(1)	*(2) males only*	*(3) males only*	*(4) males only*	*(5) males only*
Dep. Variable	ABCC	ABCC	ABCC	ABCC	ABCC
Census 1868	4.36***	3.96**	6.35***	6.59***	5.79***
	(0.000)	(0.037)	(0.000)	(0.000)	(0.000)
Female/Male	-0.01				
	(0.585)				
Copt share	**0.33*** **	**0.38*** **	**0.40** **	**0.41*** **	**0.39*** **
	(0.003)	(0.006)	(0.011)	(0.010)	(0.009)
profi share		0.20			
		(0.245)			
farmer share			0.02		
			(0.413)		
skilled share				-0.07	
				(0.185)	
unskilled share					0.02
					(0.326)
Time FE	YES	YES	YES	YES	YES
Constant	2.014	-3.49	-2.380	-0.21	-1.96*
	(0.174)	(0.148)	(0.217)	(0.624)	(0.051)
R-squared	0.498	0.524	0.519	0.531	0.517
Observations	112	94	94	94	94

*** p<0.01, ** p<0.05, * p<0.1, Robust P-Values are in brackets

Note: the 1868 census is included as a dummy variable to detect systemic differences over time. Clustering at the census and birth decade

6.8 Figures

Figure 6.1 Number of observations by occupation

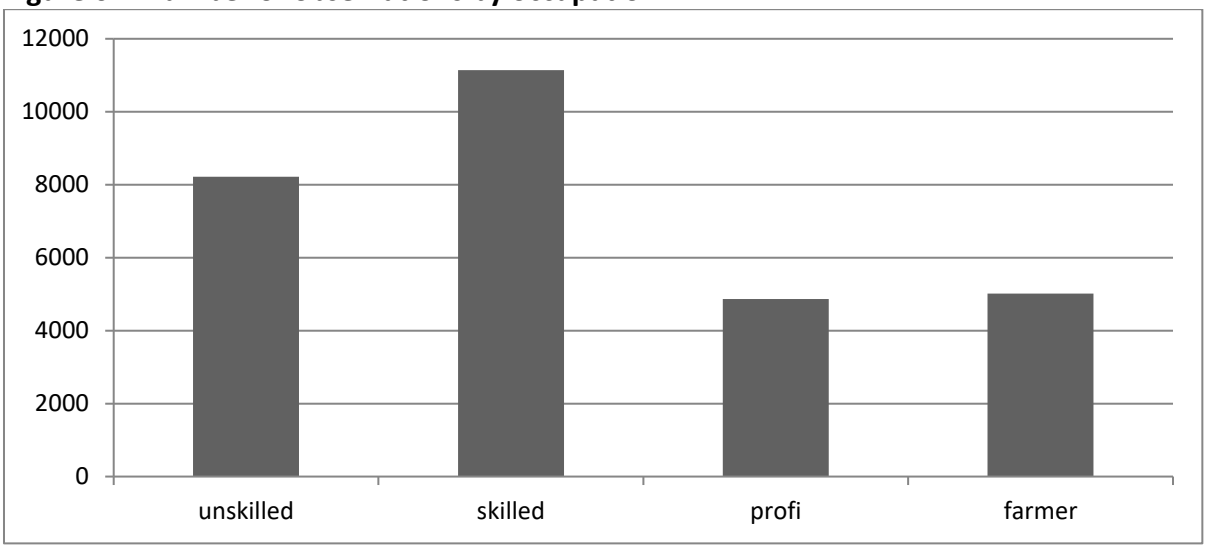


Figure 6.2 ABCC in Egypt by birth decade

Figure 6.3 Number of observations by gender

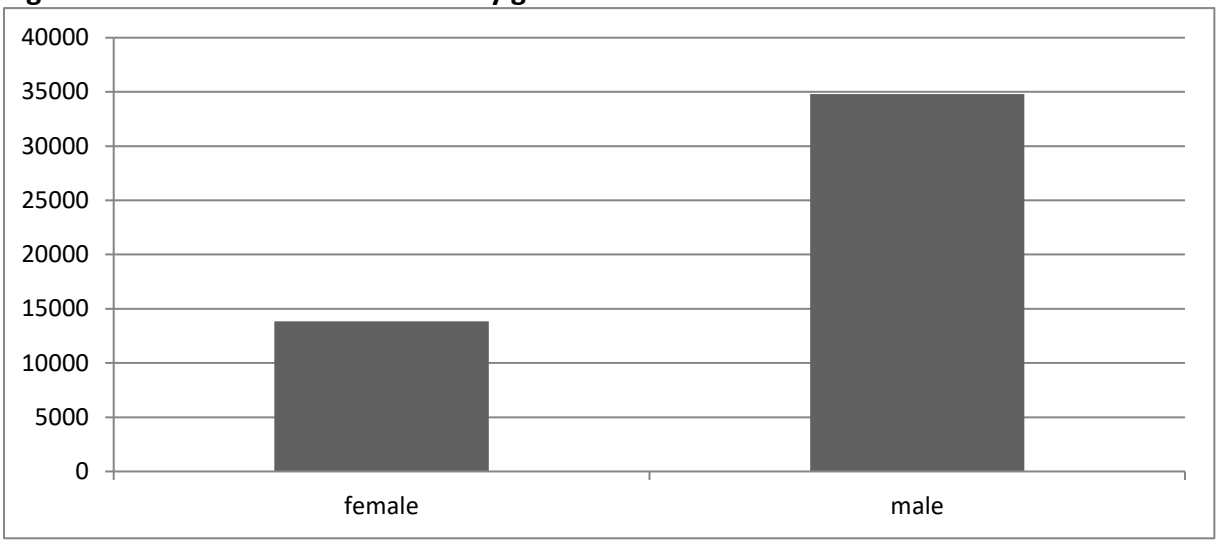


Figure 6.4 ABCC by religion

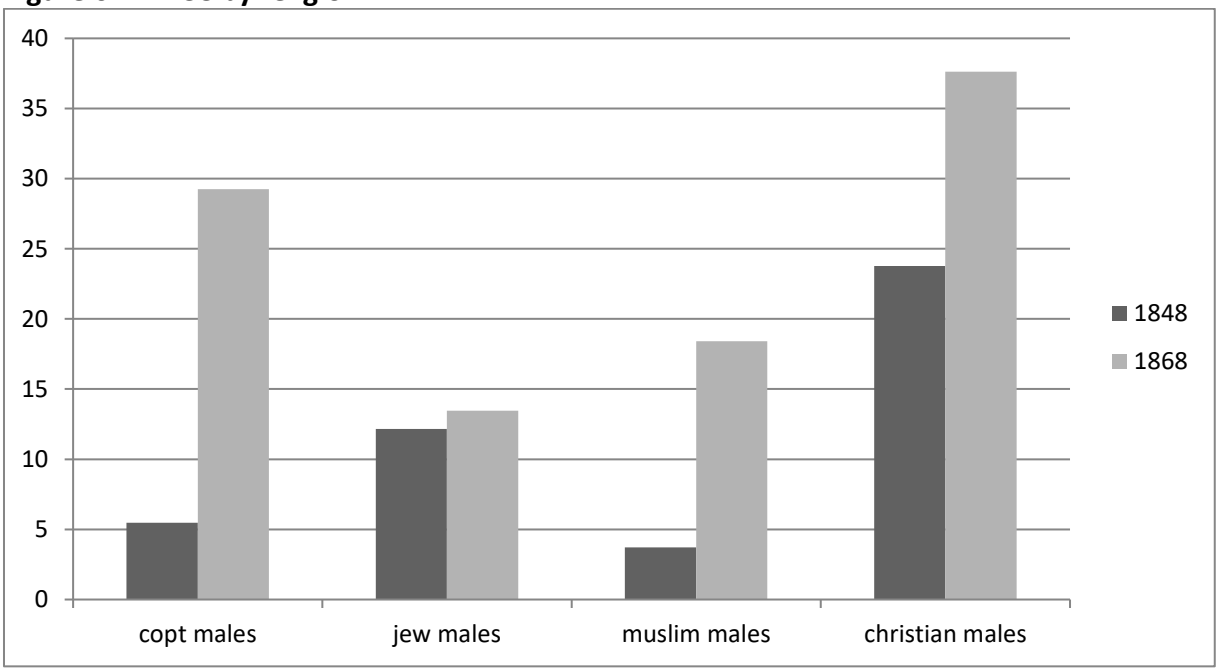


Figure 6.5 ABCC development by gender and religion

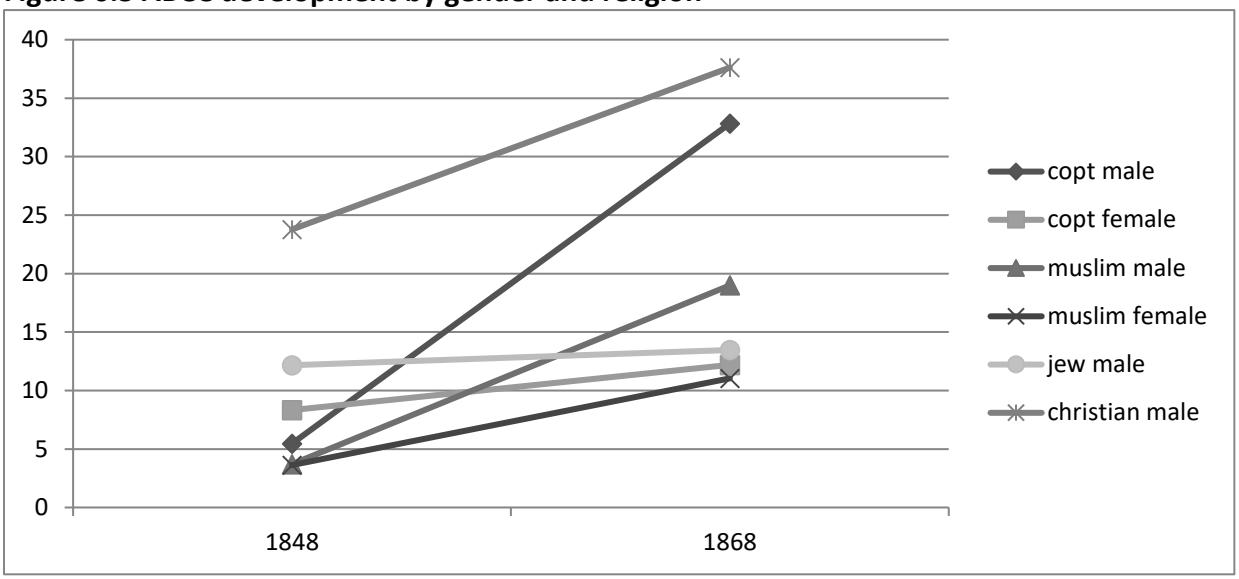


Figure 6.6 Gender gap by religion

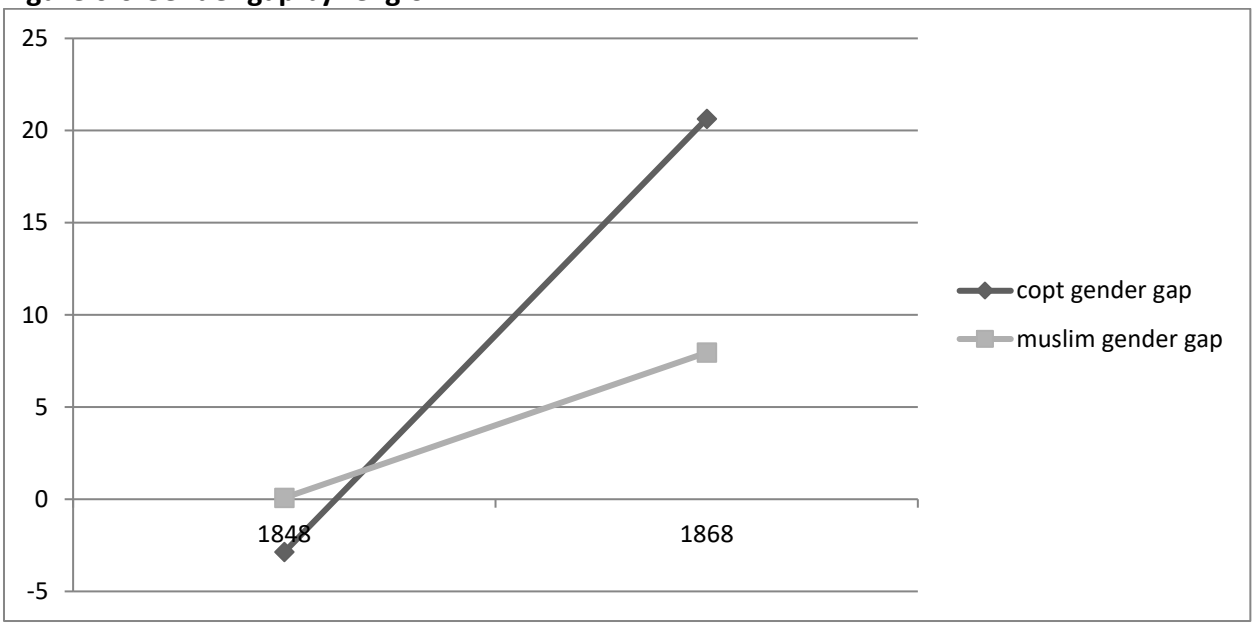


Figure 6.7 ABCC index by occupation

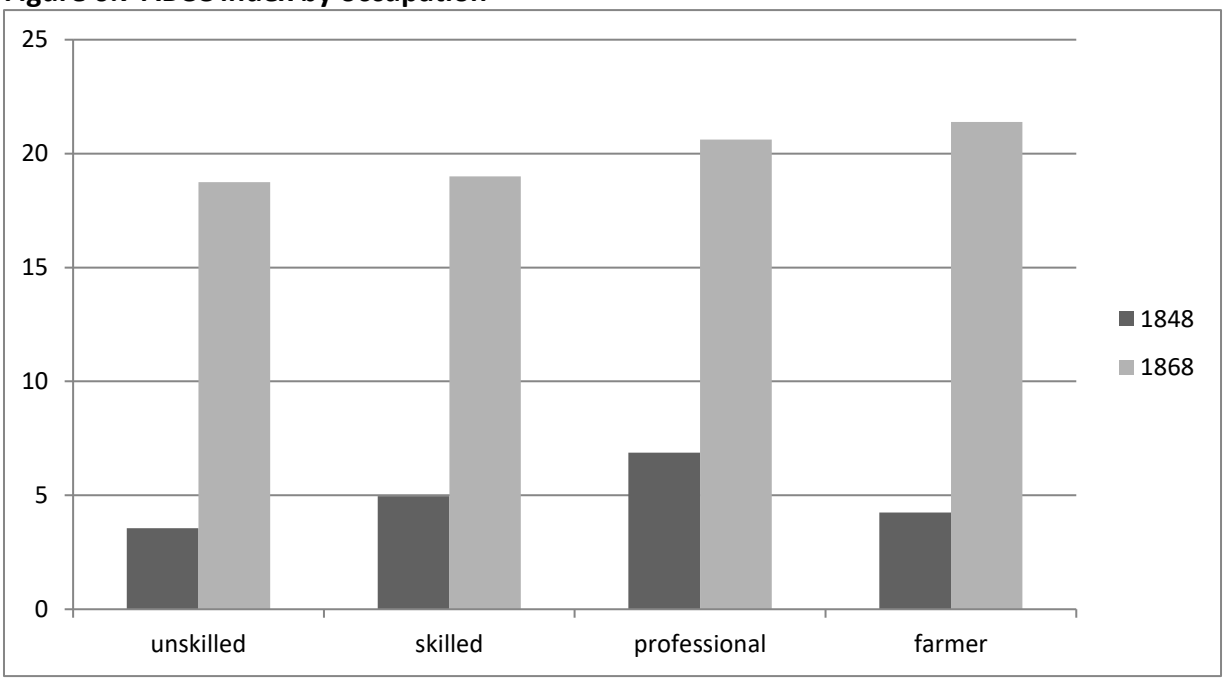


Figure 6.8 ABCC by province and census year

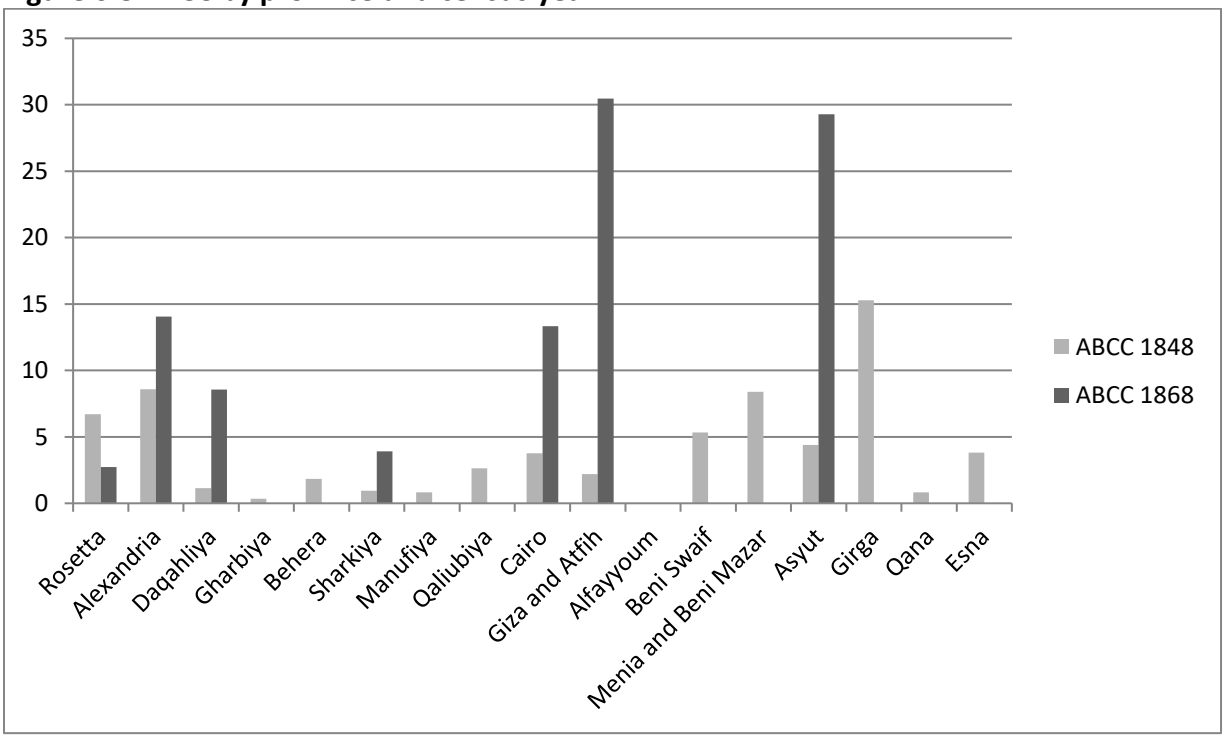
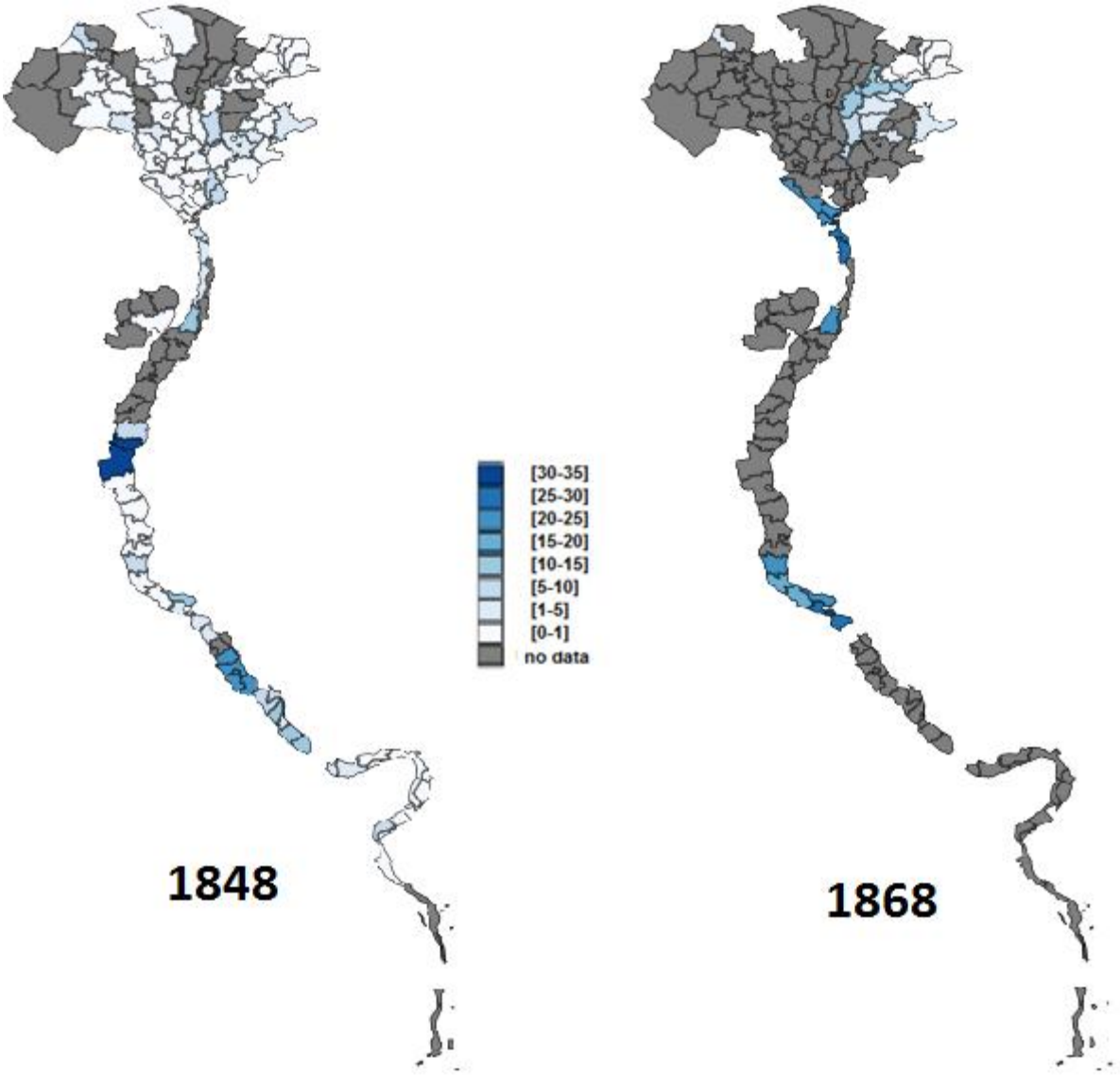


Figure 6.9 ABCC by district



7. Summary

This thesis studied the human capital development of the Middle East over the long run, covering the period 1500 to 2010. It analysed trends in the human capital of different countries of the region, focusing on the 19th and 20th centuries and enabling an overview of numeracy in the Middle East since the late Middle Ages.

In the second chapter, trends in education and human capital are studied to analyse the human capital development of the Middle East, North Africa and Central Asia between 1500 and 2010. The development of the countries in this region was very heterogeneous. The indicators used to measure human capital in this chapter were numeracy, years of schooling, heights, life expectancy and GDP growth. The Middle East showed a comparatively good nutrition level in the 19th century when compared to Europe; but this situation has changed in the twentieth century after Europe surpassed the Middle East with its average population height. In the Medieval ages, the Middle East enjoyed a greater knowledge and technological capabilities than Europe before a collapse occurred in technology and poverty ensued in the 18th century. We discussed the effects of the shifting trade routes that passed through the Middle East and the deterioration of the irrigation infrastructure in Iraq and Egypt after the late medieval plague and the Mongol invasion which drastically altered the region. We argued that in this period the Middle East's living standards were almost equal to those of Europe; a claim which is supported by other researchers' results, particularly those that found that urban craftsmen's real wages were similar to Europe from the 16th to the 18th century. Despite the existence of property rights, industrial activity and trade, the taxation system did not motivate development during that period, but a period of reform began during the early 19th century. However, the economies

of the Middle East focused on cash-crop production which led to deindustrialization. Islamic legal institutions also became handicaps to growth during the 19th century. These processes resulted in weaker Middle Eastern economies and discouraged the development of skills.

In chapter three, the hypothesis of experiencing a "Curse of Resources" is tested in the Middle East and South Asia during the 19th and 20th centuries. We tested whether the extraction of oil influenced the region's human capital negatively. By comparing numeracy and trends in years of schooling at the country level, and by running regressions of the change in years of schooling and its effect on oil production per capita and colonialism – including control variables such as fertility and religion, and including time fixed effects – we found a no significant effect of colonialism but a negative significant effect of oil production on the change in schooling years.

An overview of numeracy development in the Ottoman, Turkish and Arabic provinces was given in the fourth chapter. We used the age heaping technique and calculated the numeracy levels of the inhabitants of different provinces in today's Turkey, Iraq, Syria and Palestine; controlling for religion, ethnicity, location, economic activity and size to conclude that religion played a role in determining human capital. The results showed a significant positive effect of being a non-Muslim on the ABCC values. A significant difference between the Turks and Arabs was shown as well – Turkish individuals enjoyed significantly higher human capital than Arabs. Being from a large city had also a positive and significant effect on the individuals' numeracy level. Being from a region specialized in silk, cotton and textile production or located on a caravan route also had a significant positive influence on numeracy.

The effect of secularism on human capital in Turkey was discussed in chapter five. Using the age heaping method, we measure the numeracy of the Turkish population before

and after the secular reforms of Ataturk in the 20th century, and we compare our results to those of other neighbouring countries. We witnessed a significant effect of these secular reforms on the numeracy of the Turkish provinces. These provinces, however, did not benefit equally from the reforms; provinces with high Kurdish shares showed significantly lower numeracy levels.

In the final chapter, we went back to the 19th century to test the influence of the reforms that took place in Egypt during the time of Mohammad Ali on various sectors, such as agriculture, industry and education. We measure numeracy on the individual level and control for time, religion, gender and occupation effects. As expected, males showed greater numeracy, reflecting better education opportunities for boys. Religion and occupation also had a significant effect on the individual level. On the provincial level, however, the influence of occupational categories was insignificant but the religion effect stays significant, showing higher numeracy levels for provinces with higher shares of Copts.

In this thesis; the influences of religion, gender, occupation, ethnicity, secularism and oil production on human capital were tested for the Middle East. In addition to the years of schooling, the age heaping technique was the core method used to measure numeracy within the regions studied. Various sets of census data from the region were used throughout the analysis, relying on basic numerical skills level as an indicator of human capital. However, more aspects and indicators of standards of living and human capital can be studied in the future. The availability and access to sufficient data for the Middle East is very important for any future research.