Institutions and Economic Growth

in the Late Ottoman Empire:

A Quantitative Approach, 1820-1913

by

Johan David Vesterager Husfeldt,

jo2738hu-s@student.lu.se

Abstract

This thesis studies the institutions and economic development of the late Ottoman Empire, examining whether institutions can explain the economic development of the regions and countries subject to it during the period of 1820-1913. The thesis aims to quantify the institutional determinants of geography, religion/culture, and political economy/interests, and it employs a semi-experimental approach of using inequality extraction ratios as an indicator for the political economy. Using quantitative data analysis, the study looks for evidence of the relationship between the named institutional determinants and economic growth. The results of the empirical study find little to no evidence that geography or religion had any significant relationship with economic growth, but they do find significant evidence that the political economy, defined as the inequality extraction ratio, did have a negative relationship with growth throughout the period in study. However, the limitations of the data and the methodology render the results open to question, and the thesis encourages ample research into the subject in the future.

Acknowledgements

I would like to express my deepest gratitude to my supervisor, Jaco Zuijderduijn, who provided me with constructive feedback, encouragement, and useful answers to my questions throughout the thesis-writing process. I especially appreciated the speed at which he provided feedback for the first draft of this thesis.

I would also like to express my gratitude to my partner, Mayada Azmirly, who provided me with tremendous encouragement throughout the process and assisted me with compiling data.

Table of Contents

List of Abbreviations

CIA – Central Intelligence Agency

GDP – Gross Domestic Product

IER – Inequality Extraction Ratio

IPF – Inequality Possibility Frontier

MENA – Middle East and North Africa

MFT – Maximum Feasible Top Income Share

NIE – New Institutional Economics

OLS – Ordinary Least Squares

PPP – Purchasing Power Parity

TER – Top Income Extraction Ratio

TFP – Total Factor Productivity

USD – United States Dollars

VIF – Variance Inflation Factor

List of Tables

List of Figures

1. Introduction

The underlying causes of economic development are manifold and complex, and there is an abundance of academic literature attempting to explain them. The question of why some countries have higher incomes, productivity levels, and living standards than others has been a fundamental question of the economic discipline since its foundation. Although many theories and explanations exist, there is yet to arise a clear consensus on which factors are more important than others. This remains true both for present and historical cases of economic development (or lack thereof), and it ties into questions around the origins of the Industrial Revolution and the Great Divergence, when income levels in Western Europe and its offshoots began to dramatically outperform those of the rest of the world in the 19th century.

Among the existing theories and schools of thought, institutional economics has attempted to provide explanations that examine the deeper historical reasons that some countries have performed well economically, while others have not.

1.1 Motivation and Research Problem

The true nature of the interplay between institutions and economic development remains unclear and partly controversial, not least within the context of the Industrial Revolution and the Great Divergence. The Ottoman Empire emerges as an interesting case in the period surrounding the 19th century, traditionally having been Europe's nearest and greatest rival in the early modern era. While they are typically counted as part of the Islamic, Middle Eastern civilisation, the Ottomans had a significant presence in Europe as well, even having their capital of Istanbul (or Constantinople, as it was still often called) located on the continent. Its geographic proximity to the West puts the Ottoman Empire in a unique historical position compared to other Asian and African civilisations at the time, as it may have been the one that had the greatest potential to partake in 19th century industrialisation, while ultimately failing to do so (Pamuk, 2020).

Questions naturally emerge as to the fundamental reasons for this. For instance, why was Japan, an isolated nation on the other end of the Asian continent able to reform into an industrial power, while the Ottoman Middle East, having spent centuries in contact and direct

competition with Europe, was not (Waterbury, 1999)? From the perspective of institutional economics, the simple explanation would be that the Ottoman Empire didn't have the necessary institutional framework to facilitate investments, education, and ultimately economic growth (Pamuk, 2004a). While this theory may be intuitively appealing and may even hold significant explanatory power, institutions are notoriously difficult to quantify, as they relate far more to the underlying formal and informal rules of a given society than any easily identifiable statistic, and they can easily be confused with other similar sounding but distinct concepts, such as policies (Voigt, 2013). To quantitatively answer the question of whether and how institutions relate to economic growth, one must begin by defining a clearly measurable indicator for institutions.

Given the inherent difficulties of quantitatively measuring institutions, studies that attempt to do so remain relatively rare, especially for historical societies, where data are significantly more scarce. This is certainly the case for the Ottoman Empire; even though prominent scholars on Turkish economic history, such as Pamuk (2004a; 2020) have written extensively on the institutions of the empire, these institutions have very rarely been quantified in any meaningful data analysis. Given the popularity of institutional theories and the importance of the Ottoman Empire as a historical case, this presents a significant gap in the literature on institutions and their importance for historical economic development.

As such, the purpose of this study is to fill the research gap, both by attempting to quantify institutions in the context of the late Ottoman Empire, and by quantitatively analysing their importance to its economic development at the regional level, from the year 1820 to 1913. Lacking data for many commonly used indicators for historical institutions, the study employs a semi-experimental way of measuring institutional determinants through inequality extraction ratios, which have been devised by Milanovic et al. (2011) in the context of the discussion on historical institutions, but as of yet have not been used extensively as measures for institutional quality. Furthermore, other determinants, such as religion/culture and geography are also discussed and included as indicators in the study, as these are also relatively easy to quantify and often theorised to have a relationship to institutions and economic development (Pamuk, 2018, p. 60-61).

As such, the research question can be formulated in the following way: Can institutions explain late Ottoman economic underdevelopment?

Furthermore, an additional aim of the study is to contribute to our understanding of institutions and their historical role in shaping the outcomes of the Great Divergence, as well as our understanding of the regional economic differences of the Ottoman Empire.

1.2 Outline of the Thesis

The remainder of this thesis covers the process of answering the research question. Chapter Two provides historical context to the research question and the period of interest, describing the geopolitical and economic developments of the Ottoman Empire in relation to the rest of Europe. Chapter Three presents and discusses the background and theory of institutional economics as it is used in this study, while also providing a literature review on the topic of institutions in the Ottoman context. Chapter Four presents the choice of data and their respective data sources, as well as a discussion on the quality and potential weaknesses of these data. Chapter Five presents how the variables are being used for the study, along with an explanation of the methodological approach taken to answer the research question empirically, including robustness tests. Chapter Six presents the results of the study, while discussing the interpretation and implications of these, including how they relate to the theory and literature. Finally, Chapter Seven concludes the thesis, summarising the main points of the study and making some suggestions for future research on the topic.

2. Historical Context

This chapter provides a historical overview of the Ottoman Empire, giving a short summary of its rise to prominence, before focusing on its stagnation and decline and the various attempts to reform its institutions. The Tanzimat period is highlighted, as well as the Ottoman debt crisis and the empire's gradual territorial losses. This is followed by a discussion of the late Ottoman Empire's economy, with focus on its rising agricultural and declining manufacturing sectors over the course of the 19th century.

2.1 Overview

The Ottoman Empire arose in the early modern period as the foremost military and economic power in the eastern Mediterranean region. Having conquered much of the former territories of the old Eastern Roman Empire—including its capital of Constantinople—by 1453, the Ottomans expanded rapidly in the following centuries, bringing most of the Middle East and North Africa under their control and penetrating deep into South-Eastern and Central Europe by the mid-16th century. With its military and territorial expansion, the empire also grew in economic prosperity, becoming a vital hub of trade and commerce in the region. Much of this was thanks to the empire's geographic position, enabling it to exploit its connections between the Mediterranean and Indian Ocean, and between the continents of Europa, Africa, and Asia (Panzac, 1992). Despite the dominant position of the Ottomans at the time, estimates of historical income per capita levels have shown that most countries in Western Europe were in fact wealthier on average, even centuries before the industrial revolution (Bolt and Van Zanden, 2020). Moreover, significant economic differences existed between the various regions within the Ottoman Empire. Given the vast geographic and cultural diversity of the empire, this is perhaps not surprising, but it can potentially provide some important and interesting insights. For instance, estimates suggest that the Europeans territories, such as Hungary, tended to have significantly higher income levels than the Anatolian provinces in the late 16th century (Coşgel, 2008). Moreover, the Balkans are generally seen as having been the economically most important region, with the province of Rumelia having been the largest source of tax revenue for the empire during this time (İnalcık, 1994, p. 82). One would perhaps expect Anatolia, the Turkish-speaking heartland of the empire, to have been more

significant economically, but interestingly enough, it seems to have been relatively marginalised in this regard.

Either way, as centuries passed, the Ottomans proved unable to compete with the West in the long run, and the economic divide between the two only became deeper. The Industrial Revolution, having begun its earliest phases in late 18th century England, began expanding and spreading throughout the rest of Western Europe and its offshoots in the 19th century. Income and productivity per capita experienced significantly stronger and more sustained growth in these areas compared to the rest of the world, including the Ottoman Empire (Duzgun, 2018). The stagnation of the Ottomans was not lost on the people of the time. The empire became known as the "Sick Man of Europe", dubbed so by Tsar Nicholas I in reference to its mounting economic and geopolitical problems (Hupchick, 2002, p. 234). Over the course of the 19th century, the Ottomans would lose many of their territorial possessions in Europe and Africa to independence movements and rivalling European empires.

With their own economic and military power waning, the need for reform became increasingly apparent. The so-called Tanzimat period, which began in 1839 and ended in 1876, emerged as a response to this need, as the Ottomans attempted to reform and modernise the institutions of their empire (Pamuk, 2020). The reforms were done with an explicit Western model in mind, and they included increased secularisation, strengthened property rights, and a more efficient bureaucracy. However, the Tanzimat should not be interpreted as an attempt to completely westernise the Ottoman Empire; rather, it was a series of pragmatic decisions made out of necessity in the face of increasing internal and external pressure.

Either way, the reforms had only limited success, and they were expensive to implement and maintain. Budget deficits grew despite increases in government revenue, being only exacerbated during periods military conflict (Pamuk, 2020). In the aftermath of the Crimean War, the Ottomans fell into a cycle of increasing foreign debt in the second half of the 19th century, resulting in the state being forced to declare bankruptcy in 1875. Six years later, the Ottoman Public Debt Administration was established, partially to restore financial stability to the empire, but also to ensure a high degree of control by the Western powers, who came to act as an autonomous agent within the Ottoman state structure itself (Eldem, 2005).

Although the empire regained its creditworthiness in the 1880s, it continued to lag behind economically, and its reliance on foreign debt continued to increase (Pamuk, 2020). Moreover, it had lost many of its more productive regions in Egypt and Europe, while any

and all reforms seemed to have been too little and too late to solve the empire's underlying problems. By 1914, the empire had failed to industrialise, and it met its final end in World War I, being replaced by the modern Republic of Turkey.

2.2   The Economy of the Late Ottoman Empire

The relative economic stagnation of the Ottomans and the Middle East is well-illustrated by estimates of historical GDP per capita. From 1820 to 1913, Turkey and Egypt had an average growth rate of 0.5 percent annually, while the industrializing West had one of 1.3 percent (Pamuk, 2018, p. 135). Even the southern European economies of Italy and Spain significantly outperformed the Middle East, with average growth rates of 0.9 and 0.8 percent respectively. Compared to the rest of Asia and Africa, the Ottomans performed relatively well, but their growth rate was still nearly half that of the global average of 0.9 percent, and over the course of the period Turkey's GDP per capita went from being above the global average to below.

As mentioned previously, the changing balance of power militarily and economically forced the Ottomans and their economy to adapt to new realities. However, this did not come in just the form of the internal reform efforts of the Tanzimat. Unable to deal with its own external and internal political problems alone, the Ottoman government needed foreign support to finance and implement its own reforms. Increasing dependency on the Western powers—primarily Britain and France—resulted from this, and these demanded concessions of their own. Most importantly, this meant opening up to foreign trade and investment, as exemplified by a free trade treaty signed between the Ottoman Empire and Great Britain in 1838, just one year before the Tanzimat reforms began (Pamuk, 2020).

The Ottoman economy thus had to adapt to an increasingly complex environment of foreign competition and changes in the structure of the state. Over the course of the 19th century, foreign European merchants gained a clear advantage, as they became largely exempt from foreign customs, while internal customs within the empire remained in place for the empire's local merchants (Pamuk, 2020). Moreover, foreign enterprises gained a growing presence from the 1850s and onward, primarily in the form of railroad construction, which made up about two thirds of foreign direct investments.

Gaining a more market-based economy and facing competition from the West, the already rural and agrarian economy of the Ottoman Empire became increasingly specialised in agriculture, where it likely had a comparative advantage. Agricultural productivity also increased, in part due to increased security in the provinces of the empire brought on by reforms and the centralisation of state authority (Pamuk, 2018, p. 120). The commercialisation of the agricultural sector was a natural consequence of these factors, as the empire's exports of agricultural goods, primarily to Europe, grew steadily (p. 121). The increasing importance of trade is illustrated by the shares of imports and export to GDP, which grew steadily from 2-3 percent in the beginning of the 19th century to 11 percent at the eve of World War I (Pamuk, 2020). While all this was beneficial for the agricultural sector, other sectors where the Ottoman Empire did not have a comparative advantage suffered greatly. Despite a growing rate of urbanisation in the empire over the 19th century (Arnaud, 2015), the small but flourishing manufacturing sector that existed in the early 19th century declined to near irrelevance by 1850 (İnalcık, 1994, p. 888). With this, the prospects of industrialisation, at least in the classical sense, seemed to have been heavily diminished, as the Ottoman Empire was rendered into an agricultural exporter on the periphery of the rapidly developing European economy.

The second half of the 19th century, particularly after 1870, saw some slight signs of reversal in the trend. According to İnalcık (1994, p. 889), manufacturing output did increase during this period, both in absolute and relative terms. Pamuk (2020) backs this up, stating that a new wave of enterprises began to be established in the 1880s, though these were limited in scope and could only compete with European imports when transport costs were high, local raw materials were cheaply available, and low wages provided a significant advantage. However, this trend never reached the heights necessary to compete with the West.

3. Theory

This chapter provides a theoretical basis for the study. The main framework of institutional economics, specifically New Institutional Economics, is presented, along with a short history of its emergence. A definition of institutions is provided, along with theoretical foundations for how these affect economic development. This is followed by a literature review on institutions in the context of Ottoman economic history, which includes an overview of the institutional determinants that Turkish economic historian Şevket Pamuk deems to have been important for economic development. Finally, some preliminary hypotheses are formulated based on these determinants, which are later further developed in Chapter Five.

3.1   Theoretical Approach

The traditional understanding of economic growth and development, based largely on neoclassical theory and most famously formulated by Solow (1956), focuses primarily on the three production factors of labour, capital, and technology. Under this framework, economic growth is a function of the increase in either of these three factors, with technology usually being defined as the total factor productivity (TFP) (Acemoglu, 2009, p. 78). Inherent to the Solow growth model is also the idea of diminishing returns to capital, meaning that an economy with a large capital stock will tend to grow slower than an economy with a smaller one (p. 29). In layman's terms, poor countries have greater potential for growth, and should over time converge with rich countries in terms of income and productivity levels. However, the neoclassical school has received critique in that it inadequately explains the causes of growth outside the factors of production, and why economies sometimes fail to make the necessary investment to achieve higher growth. As North and Thomas (1973, p. 2) put it: "The factors we have listed (innovation, economies of scale, education, capital accumulation, etc.) are not causes of growth; they *are* growth". As such, the institutional school of thought and its theories have emerged as one of the alternative, or complementary, explanations to traditional neoclassical theory.

The origins of institutional economics date back as far as the late 19th century and early 20th century, traditionally being associated with notable figures such as Thorstein Veblen and John R. Commons (Rutherford, 2001). Emerging as a challenger to the neoclassical

orthodoxy of its time, this "old school" of institutional economics gained significant traction in the interwar period, but lost most of its steam by the mid-20th century. Institutional economics today far more often refers to the "New Institutional Economics" that emerged in the late 20th century, spearheaded by the likes of Oliver Williamson and Douglass North, with most modern writings on the subject of institutions using this school of thought as their theoretical foundation. While in many ways inspired by the old institutional economics, NIE has also been attempt to extend the range of neoclassical economic theory, rather than being a direct challenger to it (Rutherford, 2001). This thesis focuses primarily on the institutional framework as formulated by the NIE.

The term "institutions" refers to a broad concept that can be defined in many ways. However, for the purposes of institutional economic theory, the most commonly cited definition is the one given by North (1991, p. 1): "Institutions are the humanly devised constraints that structure political, economic and social interaction". These can take the form of both formal rules (e.g. constitutions and laws) and informal constraints (e.g. taboos, customs, and traditions). This definition focuses specifically on the abilities of said constraints to reduce transaction costs by making society and thereby economic activity more predictable. The strength of institutions ultimately lie in the behaviour that they incentivise and/or disincentivise in people, which in turn shape the economy and society. A crucial aspect of institutions under this framework is their ability to—however slowly—evolve over time, in order to adapt to changing environments and economic realities. For example, as societies grow larger and more complex, with economies moving from largely self-sufficient and socially cohesive villages toward larger, more complex networks of regional and even global trade, new institutional frameworks become necessary. The trust-based, informal constraints between villagers may need to turn into more formal rules and regulations, enforced by a state or a religion, in order to cope with the uncertainties that accumulate as markets grow larger. This evolution, however, does not necessarily have to be in an efficient direction, as institutions can facilitate economic stagnation and decline just as easily as they can facilitate growth. Thus, the central questions are about which institutions enable sustained economic development and growth, how they can be identified, and how and why they emerge (North, 1991).

As mentioned, the school of NIE was largely devised, and should be viewed, as a complement to neoclassical economics, as it attempts to describe the conditions necessary for the rational behaviours described by neoclassical theory (Rutherford, 2001). However,

attempts to answer the questions raised in the end of the previous paragraph, regarding the difficulties in explaining and measuring institutions, have also become a crucial aspect of institutional economics as a whole, as the field has become a way of interpreting and understanding history. According to Acemoglu, Johnson, and Robinson (2001), the origins of the institutions that shaped the economic development of the modern world can be traced back to the beginnings of European colonialism. The argument goes that Europeans set up institutions that were conducive to economic growth in certain areas, and set up institutions that hampered growth in others, which would have depended largely on whether these areas were friendly to large-scale European settlement or not. Paradoxically, the areas that saw a large influx of European settlers—and thus the introduction of institutions that facilitated growth—were areas that in the early days of colonialism, around the year 1500, were relatively poor compared to areas where Europeans did not settle in as large numbers (Acemoglu et al., 2002). Thus, regions like South and Central America or India, which by 1500 were significantly more urbanised and economically active than North-Eastern America or Oceania, have ended up much poorer than the modern United States or Australia by the year 2000.

This historical theory of institutions as the fundamental and long-run driver of economic growth, as formulated by Acemoglu et al. (2005), largely relies on the interplay between political and economic institutions. Simply put, institutions determine not only the aggregate outcome of the economy, but also the future distribution of resources among individuals and social groups. This potentially leads to social conflict, as some groups benefit more from a certain institutional framework than do others; the choice of institutions is therefore determined by those with political power. However, Acemoglu et al. (2005) distinguish *de jure* political power, which is determined by political institutions, from *de facto* political power, which is determined by the distribution of resources. Political institutions can be rearranged in the case that a group with de facto political power can overcome the collective action problem, meaning that the individuals in the group can begin to coordinate in favour of their group's interest rather than acting in their individual self-interest and thus assert greater influence. However, generally speaking a stable feedback loop is established as those with political power maintain their position, by controlling both the distribution of resources and political institutions in their favour. The basics of the theory are illustrated in the following schematic:

$$\left.\begin{array}{rcl}
\begin{array}{c}political\\ institutions_t\end{array} & \Rightarrow & \begin{array}{c}de\ jure\\ political\ power_t\end{array}\\[2em]
\begin{array}{c}distribution\\ of\ resources_t\end{array} & \Rightarrow & \begin{array}{c}de\ facto\\ political\ power_t\end{array}
\end{array}\right\} \Rightarrow
\begin{array}{l}
\begin{array}{c}economic\\ institutions_t\end{array} \Rightarrow \begin{cases} economic\ performance_t\\ distribution\ of\ resources_{t+1}\end{cases}\\[2em]
\begin{array}{c}political\\ institutions_{t+1}\end{array}
\end{array}$$

The model explains the persistence of institutions, and maintains that economic institutions are endogenous. Nevertheless, exogenous shocks to the system in the form of changes to the technological or international environment may, as mentioned, allow for changes in de facto political power, which can snowball into future adjustments in both political and economic institutions (Acemoglu et al., 2005). The previous example of European colonial expansion would be an example of this.

Ultimately, the institutional model serves to explain the Industrial Revolution in Western Europe, with Acemoglu et al. (2005) arguing that the conditions that allowed for its emergence in 18th century England were largely a consequence of the political struggles of the previous century, in the form of the English Civil War and the subsequent Glorious Revolution of 1688. Under the institutional framework, English institutions went from being more "extractive", in the sense that the political and economic framework benefitted a smaller group of monarchical elites at the expense of the lower classes, to more "inclusive", as the larger group of merchants and gentry managed to use their de facto political power to protect their own interests and property rights. England emerged as a constitutional monarchy, with the rights of the king limited, and power being bestowed to a broader section society, represented in the English parliament. With the prospects of state expropriation having been rendered considerably less likely due to this shift, the institutional environment would have incentivised for the increased investments in capital and technology necessary for industrialisation to occur. Similar revolutions and shifts in the distribution of power would occur throughout continental Western Europe in the subsequent 18th and 19th centuries, which allowed for the Industrial Revolution to spread to these areas as well. Most of the rest of the world, which did not follow this institutional path, would therefore also lag behind economically (Acemoglu et al., 2005).

3.2 Literature Review

With the emergence of new institutional economics and the theories derived from it, an emergent interest in economic history from an institutional perspective has taken root in recent decades, not least in the case of the Ottoman Empire. A large chunk of the literature on Ottoman political and economic institutions is written by Şevket Pamuk, though important contributions have also been made by others.

The historical consensus is that the Ottoman Empire was one such society that had an institutional environment that differed significantly from what one would find in Western Europe and its offshoots in the 17th, 18th, and 19th centuries (Pamuk, 2004a). From this perspective, it would have been no coincidence that the Ottoman Empire also failed to industrialise, nor did it transition into a fully capitalistic market economy. Using the NIE framework, Pamuk (2004a) argues that the Ottoman state maintained its power throughout its existence, only initialising institutional reform selectively when necessity called for it. The empire originally emerged in the late Middle Ages as a rapidly expanding military force, and it left many of the economic structures in the conquered provinces intact, so as to minimise risk of social unrest. This was especially true for more remote areas, such as Egypt, where the land allocation and fiscal practices were closely tied to the ancient traditions and demands of irrigated agriculture.

Through pragmatism, the central bureaucracy was able to maintain its power and keep many of its institutions intact. Other social groups, such as landowners, merchants, manufacturers, and moneychangers were unable to exert sufficient influence to directly affect the economic policies of the central state. Institutional changes thus only occurred in the service of maintaining the traditional order. Pamuk (2004a) exemplifies this by pointing to state ownership of land, urban guilds, and restrictions on private capital accumulation as pillars of the traditional power base, all of which remained intact until the second half of the 19th century. Meanwhile changes that were perceived as threatening to said power base were generally suppressed. An oft-cited example of this—which perhaps also highlights the Ottoman Empire's institutional differences with Western Europe, which existed even in earlier centuries—was the restriction of the printing press by the Ottoman sultan in 1485 (Acemoglu and Robinson, 2012, p. 213-214), which would not be lifted until the 18th century. While this likely helped preserve the Ottoman state's and religious authorities' grip on power, it likely also reduced the potential for higher levels of literacy and education in the empire.

Indeed, by the year 1800, literacy rates in the Ottoman Empire were no higher than three percent, compared to the 50 percent one would find in many Western countries, which had not placed the same restrictions on printing. In short, the pragmatism and institutional reform of the Ottoman bureaucracy ensured the empire's survival and relative stability into the late modern era, even as its sibling Islamic "gunpowder empires" (named so because of their shared reliance on early modern gunpowder technology for their military endeavours) of Safavid Persia and Mughal India disintegrated in the 18th century. However, it was not enough to enable the Ottoman Empire's transformation into a modern economy, nor its continued survival past World War I (Pamuk, 2004a).

Getting more specific about causes and mechanisms of institutions, Pamuk (2018, p. 60-61) identifies three main determinants of institutions: (i) geography or resource endowments; (ii) religion and culture; and (iii) interests or political economy, stating that the combination of these factors and how they interact largely determines the shape and evolution of institutions.

The first of these ties back to the arguments made by Sokoloff and Engerman (2000) on how certain climatic conditions determined the institutional paths taken for various societies in the Americas, which in turn is closely related to similar arguments made by Acemoglu et al. (2001; 2002) on the varying degrees of European settlement and the reversal of fortunes, which were covered in the previous section. Labour, primarily slaves, flowed to locations where the marginal product of labour was highest, which in the early modern era was the tropical lands of the New World, especially the Caribbean, which were suitable for cash crop cultivation. This ultimately shaped the institutional arrangements between New World colonies, which to greater or lesser degrees relied on specialisation in cash crops or mining, and the exploitation of a large labour pool of African slaves or native populations. The tropical colonies initially had higher income levels than continental North America, but the institutions established in the less resource-rich northern colonies would end up fostering stronger economic growth in the long run. Moreover, geography may also shape institutions depending on whether a country is landlocked or located near large and dynamic markets, as these factors contribute to the shaping of trade patterns, which in turn affect the institutional environment (Pamuk, 2018, p. 61). While Pamuk states that the geographical factor certainly has played a role in the shaping of institutions in the Middle East—such as with the case of irrigated agriculture in Egypt or the shifting of global trade from the Mediterranean to the Atlantic—he argues that geography and resource endowments were of relatively less importance compared to other determinants in the case of the Ottoman Empire. He argues

this by pointing out that per capita income levels in Europe were already higher than in the Middle East even before the intercontinental shifting of trade routes, and that the differences in natural resource endowments between Europe and the Middle East would not become significant until the final decades of the Ottoman Empire's existence, when oil became an important source of fuel (Pamuk, 2018, p. 61).

The second determinant, religion and culture, at least on the surface appears as a defining aspect of the Ottoman Empire and its differences with the West, and it's relatively easy to see how it could potentially have affected its institutional structure. As a predominantly Muslim empire, the Ottomans were heavily influenced by Islamic law, but they also ruled over a large minority of Christians and other religious groups, who under the so-called millet system had some degree of legal self-determination. The millet system was a legal norm that enabled various religious groups to shape their own laws and courts, meaning that the laws faced by individuals to a large degree depended on their religious belonging (Barkey and Gavrilis, 2016). Scholars have argued that the Islamic legal structure, while it may have been initially beneficial to the Middle Eastern economy in Medieval and early modern times, presented difficulties by the 19th for the transition into modern industrialism (Pamuk, 2018, p. 62). Pamuk (2018, p. 62), however, also argues that the connection may not be so clear, as the Ottoman state just as easily adapted and shaped Islamic law and its interpretation to suit its own changing needs. As social structures and power relations changed, so did the state's interpretation of religious laws, and more often it was politics that dominated Islam, rather than the other way around, at least according to Pamuk (2018, p. 63-64). Nevertheless, it is also true that Islamic law and the millet system were significant factors in the structure of Ottoman society, and the Ottoman elites needed the support of religious leaders to secure and legitimise their own authority (Rubin, 2017, p. 13). Religious elites certainly held more influence in state affairs than did economic elites, even if this was only for pragmatic rather than ideological reasons. The previously mentioned prohibition of the printing press was an example of this, as it was primarily a response to the potential of the technology to challenge the monopoly on knowledge that the religious authorities held. The prohibition was primarily on printing in Arabic, as this was the language used in religious Islamic contexts, and it did not actually apply to non-Muslims printing in other scripts (Pamuk, 2018, p. 64; Rubin, 2017, p. 13). Other, perhaps less direct impacts of religion on the economy were also present. For instance, Christian merchants from the Ottoman Empire, mostly Greeks and Armenians, possessed a significant advantage over their Muslims peers, because most of Europe had

instituted laws heavily restricting commerce with Muslims. Moreover, the fact that the wealthiest merchants in the empire were mostly non-Muslim likely made it even more difficult for them to gain the trust or influence needed to affect the Ottoman policy agenda (Pamuk, 2020). This general sentiment is backed up by Kuran (2004), who states that Islamic law was not inherently detrimental to economic development for most of its history, but rather that it failed to sufficiently adapt to the changing economic dynamics of the modern era. The author states that the religious minorities of Jews and Christians, having a certain level of legal autonomy, fared significantly better, adopting Western institutions such as joint-stock companies, corporations, and modern banks, which were relatively alien to Islamic society at the time.

The third and final determinant, political interests or political economy, is treated by Pamuk (2018, p. 67) as likely being the most important factor in shaping the institutions of the Ottoman Empire. Not coincidentally, it is also the determinant that plays the most important role in the theory formulated by Acemoglu et al. (2005). The power balance and social conflict between groups determines the choice of society's institutions, which in turn is either a benefit or a detriment to said groups. Pamuk largely affirms the theory, stating that "institutions do not necessarily evolve in a way that encourages economic development" (Pamuk, 2018, p. 67). In the context of the Ottoman Empire specifically, this has already been exemplified previously in this text, with the cases of the religious authorities using their influence to restrict the printing press, or local merchants being unable to influence government policy in their favour due to lack of power. In contrast to the kingdoms of Western Europe, the Ottoman state continued to serve the interests of the old, entrenched elite until the 19th century. Some fascinating observations can be made regarding the events of the late Ottoman Empire, when looking at them from the institutional lens. As described in the previous chapter, the trade liberalisation and reforms of the 19th century were largely a consequence of European powers increasingly imposing their influence on Ottoman society. The groups that the Ottoman elites had to contend with thus ended up coming from outside the empire itself, rather than inside. This may be even further evidenced by the fact that European foreign merchants, with the backing of their respective states, received significant privileges that had never been afforded to local merchants, who for centuries had been unable to affect the policies of the empire (Pamuk, 2020).

While much has been written about the institutional structure of the Ottoman Empire and how its case fits into the wider economic theory on institutions, comparatively little has been done

to quantify these writings. As mentioned previously, institutions—especially past institutions—are difficult to measure, so it is perhaps no surprise that the likes of Pamuk (2004a; 2020) or Rubin (2017, p. 1-24) have gone through lengths describing the historical course of Ottoman institutions, but haven't done any significant data analysis on the effect of Ottoman institutions on the economic development of the empire. Only some recent tentative attempts of this kind have been made by others, such as Altay et al. (2022), who studied wealth inequality and economic growth in the empire from 1650 to 1918, using an institutional perspective. Using wealth inequality—determined by an estimated Gini-coefficient—as a proxy variable for institutions, the authors argued that times of greater inequality were times of more decentralised institutions, and that the reform and centralisation efforts undertaken in the 19th century also brought down inequality levels. The data showed that periods of lower wealth inequality were indeed also periods of stronger economic growth for the Ottoman Empire, especially in the 19th century, with the authors concluding that this was due to institutions promoting economic development and more equal wealth distribution. However, they also stressed that more detailed and comprehensive data would be needed for future studies.

As mentioned, the study by Altay et al. (2022) is very recent, and other quantitative studies on Ottoman institutions are difficult to find. The use of wealth inequality as an indicator of institutional quality is nevertheless a point of particular interest, as the relationship between these has been an important point of academic discussion and debate (Chong and Gradstein, 2007). Economic inequality presents a potentially useful way—perhaps even one of the only ways—of measuring institutions in a quantitative and methodologically clear manner. It can tell us much regarding the distribution of economic value, which, according to the theory by Acemoglu et al. (2005), is a central aspect of how institutions are shaped and how they affect future economic outcomes. Chong and Gradstein (2007) found a significant relationship between income inequality and weakness of institutions for countries, using various other indicators for institutional quality, such as political rights and civil liberties. However, the question is not so simple, as there is also the well-known case of the so-called "super Kuznets curve" formulated by Van Zanden (1995), who found a positive relationship between income per capita levels and inequality in pre-industrial Western Europe. This relationship has also been found in studies for the early modern Ottoman Empire, where rising inequality was associated with economic growth (Canbakal and Filiztekin, 2013). This seeming contradiction in the relationship between institutional quality, economic inequality, and

economic growth, complicates the issue significantly. It is far from clear whether economic inequality as an indicator captures the structure of institutions, as conceptualised by Acemoglu et al. (2005), nor is it clear whether its relationship to economic growth is positive or negative. This may be due to the distinction between wealth inequality and income inequality, with each possibly having different relationships to economic growth, or it may be due to limitations in the data, or something else entirely.

The answer to the question of how wealth or income inequality interplays with institutions may be related to the writings by Milanovic et al. (2011) on the inequality extraction ratio (IER) and inequality possibility frontier (IPF). The extraction ratio is derived from the level of inequality relative to the maximum inequality possible given an economy's income level, which is meant to capture the extent to which the poorer classes are kept at or above subsistence level consumption. The higher the income lever, the more surplus can be extracted by the elite without commoners being forced into absolute deprivation, which is what the inequality possibility frontier represents. This alternative approach to understanding inequality from a historical perspective has been devised by Milanovic et al. (2011) with institutional theory in mind, with the authors making explicit references to studies by Sokoloff, Engerman, and Acemoglu et al. They also state that "The ratio offers a different perspective on how powerful, repressive and extractive were the ruling groups, their institutions and policies." (Milanovic et al. 2011, p. 268). It is possible that the extraction ratio presents a more robust way of measuring institutions compared to pure inequality, as it may account for the rising inequality associated with the super Kuznets curve, while still capturing how wealth is distributed. However, relatively few studies have attempted to quantify the issue in this way, using the inequality extraction ratio as an explicit indicator for, or determinant of, institutional setting. This may be because of limited data availability on historical economic inequality. Nevertheless, some attempts have been made in this direction, such as Alfani and Ryckbosch (2015), who studied the extraction ratios of early modern Italy and the Low Countries, attributing the relatively higher increase in the former to a more extractive institutional environment. This also coincided with stronger growth for the Low Countries, which were said to have less extractive institutions. The authors also affirmed that were was no clear trade-off in economic growth and inequality, with the extraction ratio being held as an indicator that more clearly represented the differences between historical societies.

Returning to other ways of measuring institutions, the majority of detailed quantitative studies on historical institutions still focus on Western Europe and its offshoots. These are often comparative studies focusing on the so-called Little Divergence between North-Western Europe and the rest of the continent, and they tend to use indicators and data that are difficult to translate to the Ottoman case. One example of such indicators would be the frequency of parliamentary meetings, or some other establishment of a political assembly, which came to play an increasingly important role in Western societies over the course of the late Middle Ages and early modern period (De Plejit and Van Zanden, 2016). The Ottomans had no analogous type of assembly throughout most of their history, except for some brief intermittent periods in the late 19th and early 20th centuries. This can itself be interpreted as a sign that institutional quality was poorer in the Ottoman Empire, but it also reduces the potential for deeper data analysis. Moreover, other indicators used have limited data availability for the Ottomans, such as the rate of extraordinary taxation and real interest rates (Henriques and Palma, 2022). Pamuk (2004b) writes extensively about the financial institutions, taxation, and interest rates of the Ottoman Empire, but once again provides very little usable quantitative data, besides the observation that taxation as a share of GDP went from 2 to 3 percent in the early 19th century to about 10 to 12 percent on the eve of World War I. Safe to say, the already existing difficulties of measuring institutions become even more apparent for the Ottoman Empire, and quantitative comparative studies both with other countries and at the regional level are rare.

3.3   Hypothesis Formulation

Based on the theory and literature covered in this chapter, three preliminary hypotheses regarding the effects of the institutional determinants described by Pamuk (2018, p. 60-61) are formulated:

1. The geographic determinant, however defined, is not expected to have a very strong effect on economic growth.
2. The religious determinant, however defined, is expected to have a clear relationship with economic growth, as areas that were more heavily Christian or Jewish generally had an easier time adopting Western institutions that were conducive to growth.
3. The political economy determinant, however defined, is expected to have a strong relationship with economic growth, as it is deemed to be the most important aspect of

institutions. This relationship is expected to be relatively stronger compared to the other variables.

These hypotheses serve as a basic framework for the direction of the study, and they are reformulated in Chapter Five, with the chosen variables and the direction of their relationship to economic growth being defined more clearly.

4. Data

This chapter presents the data used for the empirical analysis. The first section discusses the choice of indicators and the difficulties in establishing these. The choices are ultimately based on the institutional determinants mentioned in the previous chapter. The following section provides the data sources used for the chosen indicators. The third and final section discusses the quality of the data, highlighting potential issues with these that could affect the overall study.

4.1 Choice of Indicators

As should be apparent from the previous chapters, finding quantitative data on institutions in the past presents a host of challenges. Not only must decisions be made on what type of indicators are seen as reasonable measures of a relatively abstract concept like economic and/or political institutions, but data for these indicators are not necessarily readily available. This is especially the case for studying non-Western societies, such as the Ottoman Empire. Nevertheless, this study will build on the writings of Pamuk (2018, p. 60-61), and attempt to quantify the three determinants of institutions that were also described in the previous chapter: (i) geography or resource endowments; (ii) religion and culture; and (iii) interests or political economy. These, in turn, need to be defined more precisely, but they provide a good basis from which to proceed. The study aims to look at the countries that at some point in the 19th century, with their modern-day borders, were wholly or partially subject to the Ottoman Empire. This is hoped to provide a sufficient indication for the regional differences within the empire, while data can relatively easily be categorised for modern countries.

The geography or resource endowment determinant can be measured in many ways, as it captures several distinct concepts, ranging from the geographical distance between certain regions to the resources present in a given area. The mechanism by which it has been connected to institutions has varied depending on the historical case. While most of these are relatively easily quantifiable, a determination needs to be made what exactly is to be measured. Under the framework provided by Pamuk (2018, p. 61), the differences in natural resource endowments between Europe and the Middle East are not taken has having been of great importance before the age of oil. As such, variations in more basic factors like the

availability of agricultural land or geographic proximity to trade networks were likely to have been more important in the long run. How agricultural land endowment can affect institutions has been touched upon previously, such as with Pamuk's example of Egypt's need to shape its institutions after the needs of irrigated agriculture. It also more generally contributes to population density and land-labour ratios, and one would intuitively expect areas more friendly to agriculture to develop institutions different from more mountainous or desertous areas. The geographical proximity to trade networks has also been discussed, with the Ottoman Empire having been located very centrally in Eurasia, and having some degree of access to both Western and Eastern trade. At the local country-level, one factor that may have mattered significantly, as mentioned by Pamuk (2018, p. 61), was the availability of a coastline, which would help connect the regions of the empire to the wider world, with landlocked areas having been more isolated and potentially having their institutions affected by this. This study will therefore use data on the share of arable land as well as the coastline-to-area ratio for each country to capture these factors.

The religious or cultural determinant is relatively straightforward to measure. Muslims made up the majority of the population, but significant religious minorities, primarily Christians, were also present. This was not just the case for the Balkans, but also for the Anatolian heartland and the Middle Eastern provinces of Syria and Egypt. Jews and other groups also had some presence, but they were far smaller in number than either Muslims or Christians. How religion contributed to institutional change in the Ottoman Empire and how different religious groups fared economically has been touched upon in the previous chapter, and the perhaps most obvious way to measure it is by the share of the population belonging to a given religious group. Under the millet system of the Ottoman Empire, the legal framework each individual faced was in large part shaped by their religious belonging, and therefore the empire's local institutions would theoretically have been affected by the relative concentration of a given religious group (Barkey and Gavrilis, 2016). Thus, the local shares of religious groups are taken as being a suitable indicator for the religious/cultural determinant, and it will be used for the purposes of this study. It should be mentioned that culture, independent of religion, is given relatively little importance under this framework. The main reasons for this are that both culture and ethnicity were already heavily tied together to religion in the Ottoman Empire. Moreover, other cultural indicators besides ethnicity are very difficult to measure historically.

The third and final determinant, political interests or political economy, is perhaps the most important of all three determinants, as it largely forms the basis of theory as formulated by Acemoglu et al. (2005). Paradoxically, it is perhaps also the determinant that is most difficult to quantify and measure. This is especially the case for the Ottoman Empire, for which data on potential indicators are scarce, let alone at the regional level. Indicators like security of property rights, taxation levels, or parliamentary activity either have insufficient data or are inappropriate for the Ottoman case, for reasons mentioned in the previous chapter. As such, this study will build on the likes of Altay et al. (2022), Milanovic et al. (2011), and Alfani and Ryckbosch (2015), using inequality and, more specifically, the inequality extraction ratio as an indicator of the political economy. The use of inequality alone is taken as insufficient, as it fails to account for the relative level of income per capita, but it does have the strength of being a more universal indicator that can be used for any type of society. As the extraction ratio captures the level of economic extraction by the elite relative to the total amount of wealth available, it is taken as a sufficient indicator of the type of economic and political institutions that Acemoglu et al. (2005) describe. To reiterate, the inequality extraction ratio is the level of inequality (which can be measured in various ways) relative to the maximum level of inequality possible, which in turn is determined by the per capita income level. Unlike something like taxation rates, it can be useful for capturing other types of elite extraction that aren't necessarily directly tied to the state. The Ottoman case exemplifies this, as its growing tax share of GDP over the 19th century wasn't necessarily a consequence of elites as a whole becoming more extractive, but rather a consequence of the state becoming more efficient and centralised, possibly at the expense of local elites (Pamuk, 2004b).

Finally, data for economic development, or income levels, are also needed. GDP per capita is one of the most common, reliable, and readily available indicators for this variable, and it is near universally applicable. With recent progress being made in constructing estimates for GDP stretching back for centuries, it has also become an increasingly solid indicator for historical studies, particularly at the country-level.

4.2 Source Material

Data are retrieved for the countries that were wholly or partly subject to the Ottoman Empire by the year 1820. The two maps below visualise this: Figure 4.1 displays a map of the empire—including client states (shown in light grey)—around the year 1820, while Figure

4.2 displays the countries included in the study with modern borders. Note that areas with significant border disputes, such as Serbia-Kosovo, Israel-Palestine, and Cyprus, are counted as unified entities for simplicity's sake, and partly due to lack of data for places like Kosovo and Palestine. Altogether, 24 countries are included.
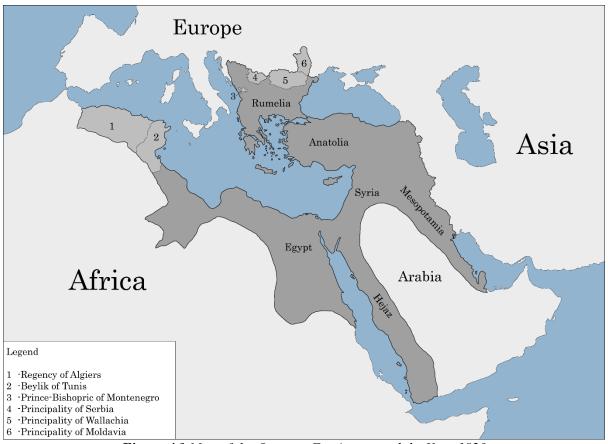

Figure 4.1 *Map of the Ottoman Empire around the Year 1820*

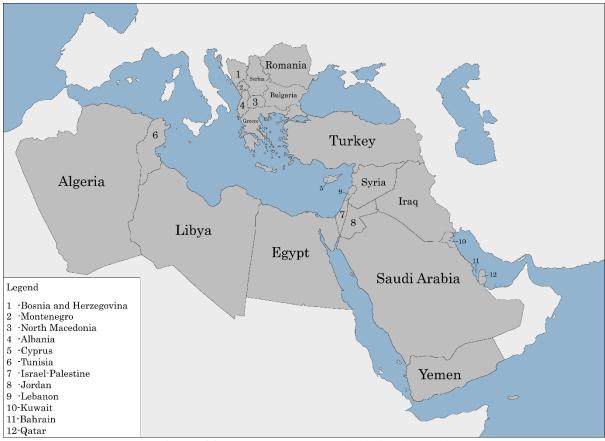Source: Author's own map based on Wikimedia Commons (2009)

Figure 4.2 *Map of Countries Included in the Study*

Source: Author's own map based on Wikimedia Commons (2009)

Data on shares of arable land for each country are retrieved from the World Bank (n.d.), for the earliest available year for each country. Karpat (1985, p. 223) also has data on agricultural land areas in many of the Ottoman Provinces in 1895. These are, however, excluded from the main study, as they are measured in a significantly different way, with the shares of arable land being shown as orders of magnitude higher than the figures from the World Bank for the same countries. Mixing the data by Karpat and those from the World Bank would be likely to impact the study negatively, as the countries using Karpat's data would be heavily biased in having much higher arable land shares than the countries using World Bank data, even though Karpat's data are closer to the studied time period.

Data on the land area of each country, measured in square kilometres are retrieved from the CIA (n.d.) World Factbook database. The same goes for the data on the coastline length of each country, measured in kilometres. As the length of coastlines can vary massively depending on the level of detail, getting all of the data from one place is also particularly important.

While the population shares of the various religious groups for the whole empire in the 19th are relatively well-known, how these break down at the local, modern country-level is more difficult to assess. As no readily available dataset has been found to present this, these data need to be constructed from the beginning. This is done primarily with the help of the Ottoman censuses that were conducted throughout the 19th century, which recorded the local religious makeup of the empire's province. The most important of these are the census of 1831 and the census of 1881-1882, which each provide some insight into the religious makeup of the empire at the beginning and end of the 19th century respectively. The data are retrieved from Karpat (1985, p. 109-150), who fortunately presents the census results quite clearly at the regional level. Three main administrative levels are presented: the province (in the form of either a so-called Eyalet or Vilayet depending on the time period), the so-called sanjak (which can be roughly equated to a county), and the district (corresponding to an individual town). To construct the needed data, each district is identified and assigned to the modern country in which it is currently (e.g. the Sofya district is identified as the Bulgarian capital city of Sofia and assigned as part of modern-day Bulgaria). Note that the census of 1831 included only males, so the figures from there are doubled to more accurately represent the "true" population sizes. Subsequently, the data for each district are aggregated by the country to which they belong, yielding estimates for the population size of each religious group. However, while the census data go a long way, they are not sufficient for every country, many of which were only partly belonging to the empire, especially by the late 19th century. Significant areas of countries like Greece, Bulgaria, and Serbia are left out of the censuses, while other countries in the Middle East and North Africa are completely excluded. Karpat (1985, p. 109-150) provides some supplementary estimates of the populations for some of these areas, such as Bosnia and Herzegovina, but significant gaps still remain. These gaps thus need to be supplemented with data from local censuses and estimates retrieved elsewhere. These supplementary data sources are indicated in Table 4.1, and they include 19th century estimates for the populations and ethnoreligious makeup of Greece, Serbia, Bulgaria, Romania, Montenegro, Egypt, and Libya. Other countries—for which 19th century data are very scarce—are given estimates on their religious makeup based on modern figures. Moreover, the final figures on religious shares derived from the data sources can be seen in the Appendix (Table A.1).

Table 4.1 Population Data Sources

Country	Data Source(s)
Albania	Karpat (1985, p. 109-150)
Algeria	Karpat (1985, p. 109-150); Author's own estimates.
Bahrain	Qubain (1955); Author's own estimates
Bosnia and Herzegovina	Karpat (1985, p. 109-150)
Bulgaria	Karpat (1985, p. 109-150); National Statistical Institute (n.d.); Koyuncu (2013)
Cyprus	Karpat (1985, p. 109-150)
Egypt	Saleh (2013)
Greece	Karpat (1985, p. 109-150); Katsikas (2021, p. 19-29, p. 72-94)
Iraq	Karpat (1985, p. 109-150)
Israel-Palestine	Karpat (1985, p. 109-150)
Jordan	Karpat (1985, p. 109-150); Author's own estimates
Kuwait	Author's own estimates
Lebanon	Karpat (1985, p. 109-150)
Libya	Karpat (1985, p. 109-150); Pan (1949)
Montenegro	Karpat (1985, p. 109-150); Lampe et al. (2023).
North Macedonia	Karpat (1985, p. 109-150)
Qatar	Author's own estimates
Romania	Karpat (1985, p. 109-150); Negruți (2014)
Saudi Arabia	Karpat (1985, p. 109-150)
Serbia	Karpat (1985, p. 109-150); Rama (2019); Jagodić (1998); Pejin (2007, p. 28)
Syria	Karpat (1985, p. 109-150)
Tunisia	Karpat (1985, p. 109-150); Author's own estimates
Turkey	Karpat (1985, p. 109-150)
Yemen	Karpat (1985, p. 109-150)

Sources presented in the table

Data for the inequality extraction ratio initially requires data on economic inequality, which can be measured in various ways. Estimates on historical inequality levels in the 19th century have only been made available in recent years for most countries, with the foremost recent dataset being the one by Chancel and Piketty (2021), which provides estimates of income inequality across the globe since 1820. The indicator used by the dataset is the share of total income received by the top income percentiles, with higher shares indicating higher levels of

inequality. It must be noted that this way of measuring economic inequality differs from Milanovic et al. (2011), who use Gini-indices as a basis for their inequality extraction ratio estimates, but income shares are taken as being an equally usable measure for inequality, and no historical database on Gini-indices is extensive enough for the purposes of the study. However, the use of income shares requires an alternative method of calculating the inequality extraction ratio, which is described in greater detail in Chapter Five. Moreover, not all specific countries that were part of the Ottoman Empire are represented by the dataset by Chancel and Piketty (2021), but regional estimates for the Middle East and Eastern Europe are present, which can be used in their stead. The inequality measures for the year 1820 can be seen graphically in Figure A.1 and the individual countries to which they have been assigned in Table A.2 in the Appendix.

Finally, data for income levels are primarily retrieved from the dataset on historical GDP per capita figures by Bolt and Van Zanden (2020), which is a continuation of the Maddison Project database. The figures are in purchasing power parity-adjusted 2011 USD, to account for inflation and exchange rates across the historical timeframe. Most countries have GDP estimates for the years 1820, 1870, and 1913, though several countries included in this study have missing data for the year 1820. The data for these a supplemented with estimates from other sources. The original dataset by Maddison (2010), for instance, has data for Greece's GDP per capita in 1820, and Pamuk (2006; 2016) provides figures for several Middle Eastern and Balkan countries in 1820. The figures by Maddison and Pamuk are, however, given in 1990 PPP dollars, which makes them incompatible with the 2011 dollars. To overcome this, the GDP figures in 1990 dollars are multiplied by 1.594 to account for the inflation that occurred between then and 2011, which is in line with how Bolt and Van Zanden (2020) originally converted many of the original Maddison figures. A recent paper by Mijatović and Zavadjil (2023) also provides historical estimates for Serbia's GDP per capita. The remaining few gaps in the Balkans are filled by extrapolating from the growth rates of the Eastern European regional figure in Bolt and Van Zanden's database, which does have data available for 1820. The data on estimated GDP per capita in the years 1820, 1870, and 1913 are represented in Table A.3 in the Appendix.

4.3 Quality of the Data

The quality of the data on the geographic indicators are generally taken as being quite high, though their use can be called into question. To begin with, the shares of arable land are not all for the 19th century. Although intuitively it may seem like a relatively time-invariant factor, modern estimates of arable land shares fail to account for desertification, oasification, and land-reclamation processes that may have occurred over the centuries. This may ultimately not have been too significant a factor affecting the numbers, but it should nonetheless be kept in mind. As mentioned previously, Karpat (1985, 2018 p. 223) has figures from the 19th century, but these were not used in the main study, even though they would be less anachronistic. On the other hand, the coastline-to-area ratios are definitely more time-invariant, though their relevance to the study can be called into question. Landlocked countries, like Serbia, would, as part of the Ottoman Empire, perhaps have more ready access to coastlines. However, the indicator still captures to some extent the amount of local coastline that would have been available, which would help determine access to trade networks and general contact with the wider world. As mentioned, the geographical determinant is especially wide-ranging in its potential ways of being quantified, and there is no universal indicator to capture exactly the types of geographical endowments that were relevant to the shaping of institutions. Nevertheless, the shares of arable land and coastline-to-area ratios are taken as sufficient proxies for what Acemoglu et al. (2001), Sokoloff and Engerman (2000), and Pamuk (2018, p. 61) are attempting to describe, and alternatives are either highly questionable in relevance or lacking in available data.

The quality of the population data used for this study can vary greatly depending on various factors. The figures from the early 19th century are especially prone to having issues. Regarding the population data, the census of 1831 was, for instance, riddles with issues and left out large sections of the population (Karpat, 1985, p. 9). It was also limited in scope, as it mostly only covered the core areas of the Balkans and Anatolia, leaving out large sections of the empire in the Middle East and North Africa. Despite the attempts by this study to ameliorate these issues, by doubling the population numbers and supplementing with estimates for other areas, they are likely not enough to make the data completely representative of the population, and they are better seen as estimates of the religious makeup rather than exact figure. The supplementary data are also not always for the exact year of 1831, though care has been taken to account for the wars and ethnic cleansings that occurred

throughout the decades. For example, the supplementary data from Greece around 1830 are taken from figures following the Greek War of Independence, (Katsikas, 2021, p. 19-29), during which many people were killed, and many Muslims were expelled from Greece, which significantly altered the religious makeup of the area. Nevertheless, despite such care being taken, it would have been preferable to have data available for the same year across the range of countries being studied, as these would've more accurately present the population shares at a particular point in time. Many of these issues also apply to the population figures from the later decades of the 19th century, but likely to a much lesser degree. The census of 1881 was significantly more ambitious than its predecessors, and it used more modern census methods to achieve more reliable results. Since data are also generally more readily available and reliable for later time periods, the supplementary data are taken as being more reliable as well. Moreover, it goes without saying that these population estimates are not for the exact years of 1820 or 1870, which means that the population data can at best be seen as estimates for the "early" and "late" 19th century, and they are only used in congruence with the economic data from these years because no better alternative was available.

The estimates made for countries with no available data are another issue that needs careful consideration. As stated, they are largely derived from what is known about their modern-day populations. For instance, the citizens of the Gulf states are overwhelmingly Muslim, and their large populations of non-Muslims are from very recent migration waves (Vora and Koch, 2015). Jordan is another country with an overwhelmingly Muslim population, and this can be safely said to have been the case in the 19th century as well. A number of Circassian refugees did settle in the region during this period (Shami, 2009), though as these were small in number and predominantly Muslim, they likely did not impact the religious makeup of the region significantly, except by making the already overwhelming Muslim majority even stronger. These types of estimates would be much less feasible for many of the Balkan states, which experienced a long series of ethnic cleansings and significant population exchanges over the course of the 19th and 20th centuries (Bell-Fialkoff, 1993), but fortunately, the countries with missing data are located on the Arabian peninsula, and have historically been more homogenous, making such estimates likely to be more reliable.

Regarding the validity of these data, the religious population data are taken as being quite valid indicators for reasons mentioned above. It is difficult to think of indicators that would more accurately capture the effect of religion and/or culture affecting the institutions and development of the empire, certainly when considering the difficulties in gathering data for

potential alternatives. Such alternatives could potentially try to more directly examine the legal structures of the millet system, or to capture how different religions or religious groups affected the policies pursued by the elites, but this would again be difficult to quantify. As such, the current indicator is taken as being sufficient for the purposes of the study.

Regarding the inequality measures, the level of detail in the chosen dataset is not very high, as many countries are not directly included and only represented as part of a regional average (e.g. Eastern Europe or the Middle East) (Chancel and Piketty, 2021). Fortunately, the period in study seemingly happens to have been a time when inequality levels were remarkably similar across both Europe and the Middle East, even when looking at individual countries, so the loss of detail is not expected to affect the study too significantly. Moreover, when the inequality figures are divided by the individual GDP per capita figures, the final inequality extraction ratio measurements have a much higher degree of variability between countries. The loss of detail is nevertheless an issue that should be kept in mind. Regardless of this issue, the data by Chancel and Piketty (2021) are likely to be the most reliable indicators of historical inequality levels available at this moment, as the literature on non-Western, pre-19th century inequality is not very extensive as of yet, and data are still quite scarce. Gini-coefficients could, for instance, have been another valid indicator, though wide-ranging data on this specific indicator in the 19th century are not readily available.

The difficulties of measuring the political economy variable have also been discussed previously, and the choice to use the inequality extraction ratio as a proxy for institutions can indeed be criticised from several angles. Not least among these concerns is the potential for significant bias in the data, as the extraction ratio is largely dependent on the level of GDP per capita. This means that countries that already have a higher level of GDP per capita tend to have a lower extraction ratio (assuming inequality levels aren't substantially higher as well), so whether it can truly be considered an independent variable is questionable, as there is a significant risk of multicollinearity. It must again be stressed that this approach to measuring institutions is still somewhat experimental, since there are—as mentioned in the previous chapter—very few examples in the wider literature using the inequality extraction ratio as an indicator for institutions. This is despite Milanovic et al. (2011) formulating its relevance to the theory on institutions. One reason for the indicator's previous lack of use may be that other variables are seen as better indicators of both political and economic institutions that are relevant to economic growth (e.g., property rights, political freedoms, free markets, etc). Indeed, the inequality extraction ratio doesn't do much to capture the

distinctions between specific institutions, let alone the important (though perhaps blurred) distinction between political and economic institutions. Nevertheless, despite these concerns, the strength of the indicator lies in its universal ability to capture the level of extraction by the economic elite of the general population, which—to repeat—is ultimately what Acemoglu et al. (2005) argue is the fundamental factor that determines institutions and economic development.

The data on GDP per capita are also generally less reliable for earlier years. Many of the issues with the various GDP estimates are discussed by Bolt and Van Zanden (2020), as they are retrieved from a large number of various sources and are at times only partial estimates for a given country. Nevertheless, many prudent steps were taken to alleviate these issues by the authors, and the dataset is likely still to be the most reliable collection of figures in the field currently. For most countries, data before World War 1 are usually only available for a select few benchmark years, most commonly 1820, 1870, and 1913. This is perhaps the largest limitation in the data, as it may not completely account for fluctuations in GDP levels, nor does it enable more detailed analysis of 19th century growth rates. Moreover, the additions and extrapolations made for the purposes of this study of course also present issues in and of themselves. The figures for countries that have no ready data going back to 1820 are merely estimates of what one would expect based on the given country's subsequent growth patterns, and they are likely to deviate at least somewhat from what the actual figures would have been. This deviation is, however, not expected to be too significant to detract from the overall results of the study.

5. Method

This chapter is dedicated to the empirical methodology used for the study and data analysis. This includes presenting the basic model being implemented, defining the variables clearly based on the data from the previous chapter, and finally laying out the main econometric approach taken to answer the research question. This includes showing how the variables are used in the model and formulating hypotheses for how these variables are expected to impact the results. Lastly, the final section discusses some robustness tests performed to further strengthen the results.

5.1 The Basic Model

The goal of the study is to examine the extent to which the determinants of institutions described by Pamuk affected the economic growth of the countries within the Ottoman Empire in the 19th century. The data are limited, so the approach used needs to be adapted accordingly. The basic model can be expressed as an equation in the following way:

$$\Delta y_{i,t-t+T} = \alpha + \beta x_{i,t} + \varepsilon_{i,t}$$

where the dependent variable $\Delta y_{i,t-t+T}$ is the change in GDP per capita for country i between the years t and $t + T$, β is the coefficient for the independent variable $x_{i,t}$, and $\varepsilon_{i,t}$ is the error term. The variables used are described in the following section. The variables used in this study are defined and presented in the following section.

5.2 Defining the Variables

This section defines the variables used in the study. The first subsection defines the GDP per capita and GDP growth rate variables, the second defines and calculates the inequality (or top income) extraction ratio, and the third and final subsection defines the remaining variables.

5.2.1 GDP Per Capita and Growth Rates

The main dependent variable, economic growth, is defined as the compound average growth rate in GDP per capita between two periods, and it is calculated in the following way.

$$\Delta y_{i,t-t+T} = \left(\frac{y_{i,t+T}}{y_{i,t}}\right)^{1/T} - 1$$

Where T is the number of years between the first period and the second period. These growth rates are calculated between the benchmark years of 1820 and 1870, and between the years 1870 and 1913. An overall annual growth rate is also calculated for the whole period of 1820 to 1913. This captures the average annual growth rate for a given country between these two years, indicating how well it performed economically. Moreover, the initial levels of GDP per capita in 1820 and 1870 are themselves also included as independent variables in their own right. The natural log is taken for these to combat the skew towards larger values.

5.2.2 Inequality Extraction Ratio

The inequality extraction ratio is derived from the relationship between income inequality and the maximum feasible level of inequality, which in turn is given from the mean income level and the minimum subsistence income (which is assumed to be at a certain level). Using Gini-coefficients, Milanovic (2013) defines his terms in the following way: G is the given level of inequality (as a Gini-coefficient), G^* is the maximum feasible inequality, m is the mean income level, and s is the subsistence level income. Stating that $\alpha = m/s$, he denotes:

$$G^* = \frac{\alpha - 1}{\alpha}$$

and finally defines the inequality extraction ratio (IER) as:

$$IER = \frac{G}{G^*}$$

Adding to this, it must be noted that Milanovic (2013) has two separate definitions of subsistence income: the physiological and the social subsistence level. The social subsistence level (σ) increases as the mean income level increases, and it derived from the physiological subsistence level (still s in this case) in the following way:

$$\sigma = s\alpha^b$$

where b is the elasticity with which the social minimum increases in relation to mean incomes, for which Milanovic considers 0.5 to be a reasonable rate for generalised purposes. The purpose of the social subsistence rate is to distinguish between the absolute income floor, below which life is unsustainable, and the relative poverty rate that increases as a society grows wealthier.

However, as the data used in this study uses top percentile income shares, rather than Gini-coefficients, this method is not exactly applicable and must be modified. Fortunately, Exenberger (2017), building on the writings of Milanovic, provides alternative way of deriving the extraction ratio from income shares. Starting with a given top population share t (e.g. the richest 10 percent or 1 percent) (also note this is not the same t as in the main model presented in the beginning of the chapter), the maximum feasible top income share (MFT_t^*) is defined as:

$$MFT_t^* = \frac{\alpha - 1}{\alpha} + t\alpha^{d_t - 1}$$

where d_t is the mean income elasticity of subsistence, theoretically sensitive to the size of the respective population share, though Exenberger sets it at a constant value of 0.5 for simplicity's sake. From here, the top income extraction ratio (TER_t^*) is derived:

$$TER_t^* = \frac{T_t - t}{MFT_t^* - t}$$

where T_t is the actual top income share. This figure is analogous to Milanovic's inequality extraction ratio, and Exenberger (2017) furthermore states that the top income extraction ratio is actually a better indicator for top-level extraction than the Gini-based inequality extraction ratio. Either way, Exenberger's method is used to derive the extraction ratio from the available data on GDP per capita and top income shares, which in turn is used as the variable for political economy. The physiological subsistence minimum income level is held to be $300 PPP in 1990 dollars, by Milanovic (2013), which would correspond to $478 PPP in 2011 dollars. However, several of the countries included are shown by the data to have had income levels far below that in 1820, and the method used to derive the extraction ratio is not compatible with figures that are below the subsistence level, as it yields unusable negative values. Instead, the physiological subsistence level is held at $200. This may be a very low estimate of the subsistence minimum required for survival, but it corresponds better with the

contemporary observed data on GDP per capita, and it yields much more usable and understandable figures for the extraction ratio. Moreover, the elasticities b and d_t are both held at 0.5 for the purposes of the study.

5.2.3 Remaining variables

Having defined and calculated the inequality extraction ratio, the remaining variables are comparatively trivial to define. The geographic variables are based on the data presented in the previous chapter and used in the following ways: the coastline-to-area ratio is derived from the length of coastline in kilometres divided by land area in square kilometres, and the shares of arable land are presented in decimal form.

The religious variable is defined as the share of the population that is not Muslim in a given country. As the vast majority of non-Muslims in the Ottoman Empire were either Christian or Jewish, this effectively captures the distinctiveness that these groups had as economic actors. The figure is derived by dividing the population of non-Muslims with the overall population, the numbers of which are gained from adding together the data by Karpat (1985, p. 109-150) with all of the supplementary data described in the previous chapter.

5.3   Summary of the Variables

A summary of the variables used is presented in Table 5.1, seen below. Since the geographic variables are taken as unchanging between periods, these are only presented once. Descriptive statistics for the variables can also be found in the Appendix (see Table A.4).

Table 5.1 *Variables Used in the Main Study*

Variable Label	Variable Description
$GDPGrowth_{i,1820-1870}$	Compound average annual growth in GDP per capita, 1820-1870
$ArableLand_i$	Share of land area that is arable
$CoastAreaRatio_i$	Ratio of coastline (km) to land area (km^2)
$ShareNonMuslim_{i,1820}$	Share of population that is not Muslim, 1820
$ExtractRatio_{i,1820}$	Top 10 percent income (inequality) extraction ratio, 1820
$ln(GDPPC_{i,1820})$	Natural log of GDP per capita, 1820
$GDPGrowth_{i,1870-1913}$	Compound average annual growth in GDP per capita, 1870-1913
$ShareNonMuslim_{i,1870}$	Share of population that is not Muslim, 1870
$ExtractRatio_{i,1870}$	Top 10 percent income (inequality) extraction ratio, 1870
$ln(GDPPC_{i,1870})$	Natural log of GDP per capita, 1870
$GDPGrowth_{i,1820-1913}$	Compound average annual growth in GDP per capita, 1820-1913

Source: see text

5.4   Methodological Approach

Having defined and presented the variables, the main model can be estimated. As mentioned, the data are quite limited, so a simple linear OLS regression is determined to be the most viable option for estimating the model. Better data availability, both in terms of number of observations and the variety of variables that could have been used, could potentially have enabled a more advanced econometric method, such as a panel data regression or a two-stage least squared instrumental variable approach. An instrumental variable approach may have been especially appropriate for this type of study, as the aim is to examine the extent to which the variables affected the overall institutional setting of the Ottoman Empire and its constituent countries, and how this in turn affected economic development. However, as data on variables for which the chosen variables could be instruments are unavailable, this was deemed unfeasible. Therefore, for the purposes of this study, the tailored estimated regressions are expressed in the following way:

$$GDPGrowth_{i,1820-1870} = \alpha + \beta_1(ArableLand_{i,1820}) + \beta_2(CoastAreaRatio_{i,1820}) +$$

$$\beta_3(ShareNonMuslim_{i,1820}) + \beta_4(ExtractRatio_{i,1820}) + \beta_5 ln(GDPPC_{i,1820}) + u_{i,t}$$

and

$$GDPGrowth_{i,1820-1870} = \alpha + \beta_1(ArableLand_{i,1870}) + \beta_2(CoastAreaRatio_{i,1870}) +$$

$$\beta_3(ShareNonMuslim_{i,1870}) + \beta_4(ExtractRatio_{i,1870}) + \beta_5 ln(GDPPC_{i,1870}) + u_{i,t}$$

with the benchmark years of 1820, 1870, and 1913 being used as cut-off points for two separate sub-periods for which the study is conducted. Moreover, a regression model for the whole period is also estimated:

$$GDPGrowth_{i,1820-1913} = \alpha + \beta_1(ArableLand_{i,1820}) + \beta_2(CoastAreaRatio_{i,1820}) +$$

$$\beta_3(ShareNonMuslim_{i,1820}) + \beta_4(ExtractRatio_{i,1820}) + \beta_5 ln(GDPPC_{i,1820}) + u_{i,t}$$

All regressions are run using the statistical and data manipulation software STATA. Note that the interpretation of these models may not be completely obvious at face value, as the included variables are meant to be proxies for the institutions, or institutional determinants that affected growth, rather than being direct causes of growth themselves. As mentioned, the simplicity of the model is a significant issue, so the eventual results can at best be seen as an indication that these institutional determinants did or did not play some role in the economic development of the late Ottoman Empire and the countries that were wholly or partly subject to it.

Lastly, the hypotheses from Chapter Three are reformulated to describe the specific effect that each variable is expected to have:

1. The geographic determinants, shares of arable land and coastline-to-area ratios, are both expected to have a positive relationship with economic growth, as more fertile regions with greater access to trade routes are expected to have an easier time adopting institutions conducive to economic growth. However, the effect is not expected to be very strong.

2. The religious determinant, share of non-Muslims, is expected to have a positive relationship with economic growth, as areas that were more heavily Christian or Jewish generally had an easier time adopting Western institutions that were conducive to growth.

3. The political economy determinant, inequality extraction ratios, is expected to have a negative relationship with economic growth, as areas with more extractive elites are implied to have had economic and political institutions that were less conducive to growth. This relationship is expected to be relatively stronger compared to the other variables.

5.5 Robustness tests

To strengthen the results of the study, some robustness tests are performed in addition to the main regression models. Some regressions are run using extraction ratios based on the top 1 percent income shares, rather than the top 10 percent, with the results being reported in Table A.5 in the Appendix. The results of these are not expected to diverge drastically from the main regressions, but they may capture some noteworthy difference as a consequence of measuring inequality slightly differently. Moreover, regressions are also run using the normal GDP per capita levels, rather than the natural log of these, to see if some significant difference can be observed. The results of these are also reported in the Appendix (see Table A.6).

To test for multicollinearity—the risks of which were discussed regarding the extraction ratios and GDP per capita levels in the previous Chapter—correlation matrices are calculated to check the correlations between each of the independent variables. These are reported in Tables A.7 and A.8 in the Appendix. Moreover, calculations for variance inflation factors (VIFs) are also implemented. VIF is a common and popular diagnostic tool for detecting multicollinearity (Alin, 2010), and it can be derived using STATA. VIF values indicate whether, and the extent to which, the variables used in a regression are dependent on each other. Typically speaking, a VIF value higher than 5 indicates that multicollinearity is significantly affecting the results. VIF calculations for the main regressions using more than one independent variable are also presented in the Appendix (see Tables. A.9-A.11).

6. Empirical Analysis

This chapter presents and discusses the results of the empirical study, including the robustness tests. The main results of the applied models are presented in table form in the in the first section. This is followed by a discussion on the interpretation and analysis of these results. The final section concludes the chapter by discussing the contribution of the study to the overall literature.

6.1 Results

The results are presented in table form below. First off are the regressions for the period of 1820-1870 (see Table 6.1). Significance levels are represented with stars and standard errors are given in parentheses.

Table 6.1 *OLS Regressions, 1820-1870*

	Dependent variable: $GDPGrowth_{1820-1870}$					
	(1)	(2)	(3)	(4)	(5)	(6)
$ArableLand_{1820}$	0.00816 (0.00870)	0.000241 (0.00901)	0.00113 (0.00657)			
$CoastAreaRatio_{1820}$	-0.00579 (0.0190)	-0.0228 (0.0197)	-0.0172 (0.0190)			
$ShareNonMuslim_{1820}$	-0.00274 (0.00399)	0.00277 (0.00366)		0.000945 (0.00249)		
$ExtractRatio_{1820}$	-0.00825** (0.00305)	-0.00268 (0.00222)			-0.00119 (0.00181)	-0.00736** (0.00272)
$ln(GDPPC_{1820})$	-0.0105** (0.00435)					-0.00927** (0.0033)
$Constant$	0.0845** (0.0313)	0.00923*** (0.00235)	0.00708*** (0.00147)	0.00654*** (0.00120)	0.00809*** (0.00207)	0.0758*** (0.0244)
N	24	24	24	24	24	24
R^2	0.331	0.115	0.042	0.006	0.019	0.284

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 6.2 OLS Regressions, 1870-1913

	Dependent variable: $GDPGrowth_{1870-1913}$					
	(1)	(2)	(3)	(4)	(5)	(6)
$ArableLand_{1870}$	-0.00701 (0.00950)	-0.00928 (0.00847)	-0.00565 (0.00603)			
$CoastAreaRatio_{1870}$	-0.00776 (0.0188)	-0.0117 (0.0172)	-0.00538 (0.0174)			
$ShareNonMuslim_{1870}$	-0.00219 (0.00383)	0.00322 (0.00332)		-0.000191 (0.00237)		
$ExtractRatio_{1870}$	-0.0125 (0.00989)	-0.00750 (0.00465)			-0.00752* (0.00430)	-0.0158* (0.00830)
$ln(GDPPC_{1870})$	-0.00333 (0.00582)					-0.00541 (0.00465)
$Constant$	0.0439 (0.0479)	0.0167*** (0.00398)	0.0107*** (0.00135)	0.00971*** (0.00112)	0.0160*** (0.00371)	0.0607 (0.0386)
N	24	24	24	24	24	24
R^2	0.201	0.186	0.042	0.000	0.122	0.175

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 6.3 OLS Regressions, 1820-1913

	Dependent variable: $GDPGrowth_{1820-1913}$					
	(1)	(2)	(3)	(4)	(5)	(6)
$ArableLand_{1820}$	0.00171 (0.00834)	-0.00398 (0.00817)	0.00200 (0.00603)			
$CoastAreaRatio_{1820}$	-0.00555 (0.0182)	-0.0178 (0.0179)	-0.0118 (0.0174)			
$ShareNonMuslim_{1820}$	-0.000570 (0.00383)	0.00339 (0.00332)		0.000482 (0.00227)		
$ExtractRatio_{1820}$	-0.00667** (0.00292)	-0.00267 (0.00201)			-0.00156 (0.00162)	-0.00653** (0.00254)
$ln(GDPPC_{1820})$	-0.00753* (0.00435)					-0.00747** (0.00310)
$Constant$	0.0649** (0.0300)	0.00109*** (0.00213)	0.00873*** (0.00135)	0.00799*** (0.00109)	0.00977*** (0.00186)	0.0644*** (0.0227)
N	24	24	24	24	24	24
R^2	0.256	0.121	0.024	0.002	0.040	0.248

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

As can be seen, the only variable representing the institutional determinants that shows any significant results is the inequality extraction ratio variable. A negative correlation is consistently shown, regardless of whether other variables are included in the model. The same applies to the logged initial level of GDP per capita. The remaining variables show much more dubious results, however, and none reach any level of significance. The

geographic determinant of arable land shares is shown to sometimes have positive, and sometimes negative correlations, depending on the time period and which other variables are included. The coastline-to-area ratio is always shown to have a negative correlations, though once again the results are not significant. Regarding the religious determinant, this variable also fluctuated between having a positive or negative relationship to economic growth, with overall insignificant results.

Worth noting is that the extraction ratio variable shows significant results only when initial level of GDP per capita is controlled for in Tables 6.1 and 6.2. However, for Table 6.2, significance is only reached when the remaining determinant variables are excluded, while it seems to matter relatively little whether the model controlled for initial level of GDP per capita. Overall, the results for the period of 1820-1870 and the whole period of 1820-1913 are the most similar to each other. This is perhaps not so surprising, as they use the same independent variables, though it indicates that the second subperiod of 1870-1913, did not play as important a role to the overall picture. The regressions using the top 1 percent income extraction ratio did not yield significantly different results from the main regressions (see Table A.5 in the Appendix). Moreover, running regressions without logging the level of GDP per capita did not drastically change the outcome of the results, either (see Table A.6 in the Appendix), though the results for the initial level of GDP per capita for the period 1820-1913 yielded an insignificant p-value.

6.2   Discussion

As stated previously, the limitations of the data and the econometric method prevent any conclusions drawn from the results from being too definitive. However, some interesting observations can nonetheless be made. For instance, Pamuk's (2018, p. 61) argument that geography played a relatively unimportant role seems to be supported by the results, which showed insignificant results for the geographic determinants. This may especially be the case for the variable on arable land share, where the results were quite contradictory. The implications of the negative correlation between coastline ratios and growth is that countries with relatively less coastline had stronger growth, even when controlling for initial level of GDP per capita, which runs counter to the hypothesis. However, as the results are not significant, one should be careful to put too much weight on this finding, as it is very probable that it is due to issues with the data.

The dubious results of the religious shares are also difficult to interpret, though data issues are once again likely to be the main culprit. The hypothesis expected a positive correlation between the share of non-Muslims (primarily Christians and to a lesser extent Jews) and economic growth, for reasons formulated in Chapter Three, but no clear evidence was found for this. Some of the regressions even showed that there was in fact a negative correlation instead, indicating that areas with a lower share of non-Muslims had weaker growth. Whatever the effects the various religions had on the institutional structure and economic development of the Ottoman Empire, they do not seem to have been significant enough to affect the results of this study one way or the other. Once again, however, these results were all insignificant, meaning that this issue very much remains an open question.

Finally, extraction ratios had the most clear results, and they were in line with the expectations of the hypothesis. Indeed, the results indicate that areas with more extractive elites also tended to have lower growth rates, which would fit well with the theory formulated by Acemoglu et al. (2005) that elites with political power would create economic institutions that benefitted themselves, but prevented or otherwise disincentivised investments that would induce overall economic development and benefit the general populace. As stated previously, the political economy aspect to institutional development is probably the most important determinant examined in this study, so these results are not surprising. However, the problem with biased data must not be forgotten either, especially in the case of inequality extraction ratios. As discussed in Chapter Four, it is very possible that the significance of the results are due to multicollinearity, as the extraction ratio is partly derived from the initial level of GDP per capita. Therefore, having both the extraction ratio and the logged initial level of GDP per capita included as independent variables may induce significant bias and overestimate the effect that the extraction ratio has. Indeed, the correlation matrices (see Tables A.7 and A.8 in the Appendix) show a clear negative relationship between the extraction ratio and initial level of GDP per capita. On the other hand, the VIF values did not show any value higher than 5 for any of the variables of 1820, though the highest values were shown for the extraction ratios and initial levels of GDP per capita. The VIF value only barely surpassed 5 in one instance for the initial level of logged GDP per capita in 1870 (see Table A.10 in the Appendix) of the second period. While this indicated significant multicollinearity, this was not for a regression that showed significant results for either the extraction ratio or initial level of GDP. Moreover, Table 6.2 showed a weakly significant result for the extraction ratio variable even without controlling for initial level of GDP. The overall results also show a

consistently negative correlation, regardless of which other variables are included. Altogether, there is indication that some degree of multicollinearity is present in the model, but not necessarily to the extent that it invalidates the findings of the study. It should also be mentioned that the negative relationship between initial level of GDP and growth indicates that there was a degree of economic convergence within the Ottoman Empire, meaning that poorer areas had a relatively higher growth rate over the course of the period studied. But the data also indicate that these poorer areas/countries had significantly lower degrees of inequality, which would be consistent with the overall findings.

Moreover, the experimental aspect of using the inequality extraction ratio demands significant consideration, as its strengths as an indicator needs additional scrutiny in future research. The growing body of literature and data on historical inequality estimates should enable better opportunities for studying the relationship between the IER and other variables and proxies for institutions. The strength of property rights, or the frequency of parliamentary activity, as with the example of De Plejit and Van Zanden (2016), could be good examples of this, and one would have to examine whether these correlate significantly to inequality extraction ratios, at least for the countries for which there available data. If the IER is indeed a good indicator of institutions, one should expect a clear negative relationship between it and parliamentary activity, for example. Establishing a clearer relationship between inequality extraction ratios and more commonly accepted variables for institutions would be a major step in clearing up the issues highlighted by this study.

Another issue also lies with the choice of studying this topic at the country-level. The study ignores the actual borders of the studied time period, and assumes that the modern geographic boundaries can be treated as valid units of observation. This is in part done out of necessity, due to most data being available only at the country-level, but future studies would do well to study the economic development of the Ottoman Empire at an even more specific regional level, accounting for the borders that were actually present at the time. Much more could also be done to observe the specific institutional paths taken by countries as they gradually gained independence from the Ottoman Empire. It is far from immediately obvious how exactly to quantify the determinants of institutions described by Pamuk (2018, p. 60-61), let alone how to isolate their effects from other factors that affect economic development, and the variables may also risk capturing things that have nothing to do with institutions (the geography variables seem to be at the greatest risk of this). Nevertheless, the results of the study indicate that at least one of the institutional determinants described by Pamuk (2018, p. 60-61) did

play some role in shaping the economic development of the countries constituting the late Ottoman Empire. If one takes the inequality extraction ration as a suitable indicator for the level of extraction imposed on the populace by elites, itself a proxy for the political and economic power held by these elites, and if one accepts the theory by Acemoglu et al. (2005) that this determines the institutions established in a given economy, then the results seem to at least partly affirm this theory.

Inevitably, however, this begs the question. It may be a perfectly valid observation that the Ottoman Empire, or at least large parts of it, had extractive elites and institutions that hampered economic growth, which led to its economic stagnation in comparison to the industrialising West. On the other hand, this explanation does not account for why that was ultimately the case; why extractive elites emerged and persisted in a manner different from Western Europe. The hope of this study was that perhaps other factors, such as geography or religion, could have been shown as having played some part in helping to explain this, but— as established—no clear evidence was found by this study that these factors had a significant impact. Future research is clearly needed to better understand, and quantify, the fundamental causes of the Ottoman institutional path. Moreover, it is also likely that any explanation would have to go beyond the 19th century, as these potential causes probably originated long before then. However, as data for the early modern period and before are even more scarce than for the period examined by this study, exploring the long-run institutional developments of the Ottoman Empire in a quantitative way—and how these compare to Western Europe, for example—would be no small feat.

6.3   Contribution to the Literature

As stated previously, quantitative studies on the institutions of the Ottoman Empire and how they related to economic development are few and far between. It should also be readily apparent from this thesis that quantifying institutions is very difficult, especially for historical cases going back before World War I. Nevertheless, this thesis contributes to the literature by quantifying the institutional determinants described by Pamuk (2018, p. 60-61), and by studying how these affected economic growth in the Ottoman Empire at the country-level. It explicitly does so with the theory on institutions formulated by Acemoglu et al. (2005) in mind, and it attempts to fill the knowledge gap on how exactly institutions shaped the economic development of the late Ottoman Empire, by observing how the countries that

comprised it fared over the course of the 19th and early 20th century, itself a critical period of industrialisation and economic development for many countries around the world. No findings in this study explicitly contradict the writings of Pamuk or other authors on the topic of Ottoman institutions. Indeed, they seem to affirm the broader theory that the political economy played an important role in shaping the growth of the Ottoman Empire, and the idea that geography played a relatively unimportant role, at least on the surface level. Nevertheless, the findings do call into question the importance of religion as an institutional determinant. This is not to say that religion played no significant role, but it does say that proving its importance as a contributor to Ottoman economic development quantitatively likely requires better data, a more clearly defined theory on its potential impact, and a higher degree of econometric sophistication.

Another important contribution of the study lies in its implementation of a semi-experimental method of using the inequality extraction ratios (specifically, income-share extraction ratios), as formulated by Milanovic et al. (2011) and Exenberger (2017), as an indicator for the political economy, which according to theory is the fundamental shaper of institutions. This is not too dissimilar from the study by Altay et al. (2022), who argued that inequality was an indicator for institutional quality in the Ottoman Empire, though this thesis attempts to go even further with examining and developing this idea. The results also largely conform to the findings of Altay et al., as they found that times of lesser inequality were also times of higher economic growth, though this thesis aims to go even further beyond by using inequality extraction ratios instead. In this sense, the findings also align with those of Alfani and Ryckbosh (2015), who also found that inequality extraction ratios had a negative relationship with economic growth. Whether extraction ratios are ultimately deemed to be a useful metric for historical institutions by future research remains to be seen, though it is clear that for this to become a viable indicator in the long run, more extensive and detailed data on inequality would be required, along with a more solid theoretical basis for its use.

7.   Conclusion

This thesis examined the economic development of the late Ottoman Empire during the 19th and early 20th centuries. The purpose was to quantify the institutional determinants described by Şevket Pamuk and study how and whether these related to economic growth in the various countries that constituted the empire. These determinants were defined as geography, religion/culture, and political economy, and variables were chosen to represent them accordingly. The main contribution of the thesis lies in this quantifying of institutions in the Ottoman context, especially when it comes to the political economy aspect of institutions. Three hypotheses were formulated on the effects of these determinants: first that the geographic variables would play a relatively unimportant role, but ultimately have a positive relationship with economic growth; that the religious variable would have a positive relationship with economic growth; and finally that the political economy variable would have a negative relationship. Data were retrieved from various sources and regressions were run for testing the relationship between the institutional determinants and growth in GDP per capita. Regressions were run for the subperiods of 1820-1870 and 1870-1913, as well as for the whole period taken together. No clear evidence was found that geography or religion as institutional determinants had any significant influence on economic growth, but the political economy, defined as the extraction ratio of economic elites, did show a significant negative relationship to economic growth in some cases for both subperiods. While there was likely some degree of multicollinearity contributing to this relationship, the calculations on the variance inflation factors of the regressions indicated that this was not deemed severe enough for one to discount the finding.

The conclusion can be said to affirm the theory of Acemoglu et al. (2005), that extractive elites set up institutions for their own benefit to the detriment of general economic development. This conforms with the larger body of qualitative literature on how the Ottoman elites shaped institutions to suit their own needs and maintain their own power. Depending on one's perspective, the reform attempts of the 19th century either failed because they didn't bring the Ottoman Empire into an era of modern industrial growth, or they achieved exactly what they were supposed to achieve, which was to do the bare minimum to keep the state functioning and the elites in power. The countries which would gradually gain their independence from the Ottomans over the course of the 19th and 20th centuries had varying growth rates, where those with a lower inequality extraction ratio generally had

stronger growth leading up to World War I. Nevertheless, the counterargument can also be made that this relationship is due to something not related to institutions. Indeed, the use of the inequality extraction ratio as an indicator is an important aspect of this thesis that could serve as a springboard for future research, as has been touched upon. Establishing a stronger theoretical and empirical foundation for the extraction ratio as an institutional determinant (or indeed refuting such a foundation) should be very feasible, at least for Western Countries with more available data. Another potential avenue for future research would be to identify other quantifiable variables for institutions relevant to economic development, with data available for the Ottoman Empire and other historical societies. More data and more variables would potentially enable more advanced quantitative research methods as well, such as panel data or instrumental variable regressions, though—as stated—finding usable data may be a significantly more challenging task. As mentioned previously, it remains to be seen whether inequality extraction ratios can be consistently used as broad indicators of institutions. If future research concludes that they can't, this would present new challenges in identifying other potential variables. Nevertheless, this thesis has attempted to take a step in the direction of quantifying the institutional variable, when other metrics are not available.

The idea that institutions were the primary underlying cause of the Industrial Revolution and Great Divergence is of critical importance to our interpretation of history, not least when it comes to the Ottoman Empire. As has been mentioned, the empire's internal economic, geographic, and cultural diversity and its placement on the fringes of Europe's civilisational frontier gives it an important role to understanding this history, as reflected by the findings of this thesis. While the results can be seen as a good first step in examining the economic development in the empire on a quantitative basis and from an institutional perspective, the need for better data and more advanced methodologies for analysing these data cannot be overstated. Much still remain unknown about the historical institutional and economic structures of many nations across the Balkans, Middle East, and North Africa, both at the macro- and micro-level, and so developing strong foundations for future research remains a significant challenge. While it can be said with reasonable confidence that institutions played an important role in the economic development of the Ottoman Empire and the world, and that they probably did so in a manner conforming to the theory that institutional economics has developed, we are still far from quantitatively describing this historical development in full detail. It seems intuitively unlikely that geography, religion, or even other factors not covered by this study did not significantly impact the historical development of the territories

comprising the Ottoman Empire, as compared to the developments observed in Western Europe, but the questions still remain as to how and to what extent. Moreover, the deeper roots of the issue should be better understood as well, as the true origins of the institutional differences both within the Ottoman Empire and compared to other parts of the world, have also been far from identified.

References

Acemoglu, D. (2009). Introduction to Modern Economic Growth. Princeton University Press, Princeton.

Acemoglu, D. and Robinson, J. A. (2012). Why Nations Fail: The Origins of Power, Prosperity, and Poverty. Currency, New York.

Acemoglu, D.; Johnson, S.; and Robinson, J. A. (2001). The Colonial Origins of Comparative Development: An Empirical Investigation. *The American Economic Review*, Vol. 91, No. 5, pp. 1369-1401.

Acemoglu, D.; Johnson, S.; and Robinson, J. A. (2002). Reversal of Fortune: Geography and Institutions in the Making of the Modern World Income Distribution. *The Quarterly Journal of Economics*, Vol. 117, No. 4, pp. 1231-1294.

Acemoglu, D.; Johnson, S.; and Robinson, J. A. (2005). Institutions as a Fundamental Cause of Long-Run Growth. In Aghion, P. and Durlauf, S. N. (Eds.). Handbook of Economic Growth, Volume 1A, (pp. 385-472), Elsevier, Amsterdam.

Alfani, G. and Ryckbosch, W. (2015). Was there a 'Little Convergence' in inequality? Italy and the Low Countries compared, ca. 1500-1800. *Università Bocconi Working Paper*, No. 557.

Alin, A. (2010). Multicollinearity. *John Wiley & Sons,* Vol. 2, pp. 370-374.

Altay, D.; Göksal, K.; and Kirmizikuşak, H. N. (2022). The Wealth of Ottoman Individuals by Different Socio-Economic Groups, 1650-1918: A Descriptive Analysis in the Context of Institutional Change. *Süleyman Demirel University Visionary Journal*, Vol. 13, No. 33, pp. 236-253.

Arnaud, J.-L. (2015). Modernization of the Cities of the Ottoman Empire (1800-1920). *HAL open science*. Available online: https://shs.hal.science/halshs-01219076/document [Accessed 23 May, 2023].

Barkey, K. and Gavrilis, G. (2016). The Ottoman Millet System: Non-Territorial Autonomy and its Contemporary Legacy. *Ethnopolitics*, Vol. 15, No. 1, pp. 24-42.

Bell-Fialkoff, A. (1993). A Brief History of Ethnic Cleansing. *Foreign Affairs*, Vol. 72, No. 3, pp. 110-121.

Bolt, J. and Van Zanden, J. L. (2020). Maddison style estimates of the evolution of the world economy. A new 2020 update. *Maddison-Project Working Paper*, No. 15.

Canbakal, H. and Filiztekin, A. (2013). Wealth and Inequality in Ottoman Lands in the Early Modern Period. Presented at AALIMS – Rice University Conference on the Political Economy of the Muslim World, Houston.

Chancel, L. and Piketty, T. (2021). Global Income Inequality, 1820-2020: the Persistence and Mutation of Extreme Inequality. *Journal of the European Economic Association*, Vol. 19, No. 6, pp. 3025-3062.

Chong, A. and Gradstein, M. (2007). Inequality and Institutions. *The Review of Economics and Statistics*, Vol. 89, No. 3, pp. 454-465.

CIA (n.d.). The World Factbook. CIA.gov. Available online: https://www.cia.gov/the-world-factbook/about/ [Accessed 23 May, 2023].

Coşgel, M. M. (2008). Estimating Rural Incomes and Inequality in the Ottoman Empire. *International Journal of Middle East Studies*, Vol. 40, No. 3, pp. 374-375.

De Plejit, A. M. and Van Zanden, J. L. (2016). Accounting for the "Little Divergence": What drove economic growth in pre-industrial Europe, 1300-1800? *European Review of Economic History*, Vol. 20, No. 4, pp. 387-409.

Duzgun, E. (2018). Property, Geopolitics, and Eurocentrism: The "Great Divergence" and the Ottoman Empire. *Review of Radical Political Economics*, Vol. 50, No. 1, pp. 24-43.

Eldem, E. (2005). Ottoman financial integration with Europe: foreign loans, the Ottoman Bank and the Ottoman public debt. *European Review*, Vol. 13, No. 3, pp. 431-445.

Exenberger, A. (2017). The logic of inequality extraction: An application to Gini and top incomes data. *University of Innsbruck Working Papers in Economics and Statistics*, Vol. 2017, No. 9.

Henriques, A. and Palma, N. (2022). Comparative European Institutions and the Little Divergence, 1385-1800. *Journal of Economic Growth*. Available online: https://doi.org/10.1007/s10887-022-09213-5 [Accessed 17 May, 2023].

Hupchick, D. P. (2002). The Balkans from Constantinople to Communism. Palgrave
Macmillan, New York.

İnalcık, H. (1994). An Economic and Social History of the Ottoman Empire. Cambridge
University Press, Cambridge.

Jagodić, M. (1998). The Emigration of Muslims from the New Serbian Regions 1877/1878.
Balkanologie, Vol. 2, No. 2. Available online:
https://doi.org/10.4000/balkanologie.265 [Accessed 25 April, 2023].

Karpat, K. H. (1985). Ottoman Population, 1830-1914: Demographic and Social
Characteristics. University of Wisconsin Press, Wisconsin.

Katsikas, S. (2021). Islam and Nationalism in Modern Greece, 1821-1940. Oxford University
Press, Oxford.

Koyuncu, A. (2013). The Population of Eastern Rumelia Before the 1877-1878 Russo-
Turkish War. Available online:
https://repository.globethics.net/handle/20.500.12424/1982676 [Accessed 25 April,
2023].

Kuran, T. (2004). Why the Middle East Is Economically Underdeveloped: Historical
Mechanisms of Institutional Stagnation. *The Journal of Economic Perspectives*, Vol.
18, No. 3, pp. 71-90.

Lampe, J. R.; Poulsen, T. M.; and Allcock, J. B. (2022). Montenegro. *Encyclopedia
Britannica*. Available online: https://www.britannica.com/place/Montenegro
[Accessed 25 April, 2023].

Maddison, A. (2010). Historical Statistics of the World Economy: 1-2008 AD. Available
online: http://www.ggdc.net/maddison/Historical Statistics/horizontal-file_02-
2010.xls [Accessed 17 May, 2023].

Mijatović, B. and Zavadjil, M. (2023). Serbia on the path to modern economic growth. *The
Economic History Review*, Vol. 76, No. 1, pp. 199-220.

Milanovic, B. (2013). The inequality possibility frontier: the extensions and new applications.
Comparative Institutional Analysis Working Paper Series, Vol. 2013, No. 1.

Milanovic, B.; Lindert, P. H.; Williamson, J. G. (2011). Pre-Industrial Inequality. *The Economic Journal*, Vol. 121, No. 551, pp. 255-272.

National Statistics Institute (n.d.). Population Structure By Religion. Bulgarian National Statistics Institute. Available online: https://www.nsi.bg/Census/StrReligion.htm [Accessed 25 April, 2023].

Negruți, S. (2014). The Evolution of the Religious Structure in Romania since 1859 to the Present Day. *Revista Română de Statistică*, Supplement No. 6, pp. 39-47.

North, D. C. (1991). Institutions. *The Journal of Economic Perspectives*, Vol. 5, No. 1, pp. 97-112.

North, D. C. and Thomas, R. P. (1973). The Rise of the Western World: A New Economic History. Cambridge University Press, Cambridge.

Pamuk, Ş. (2004a). Institutional Change and the Longevity of the Ottoman Empire, 1500-1800. *The Journal of Interdisciplinary History*, Vol. 35, No. 2, pp. 225-247.

Pamuk, Ş. (2004b). The evolution of financial institutions in the Ottoman Empire, 1600-1914. *Financial History Review*, Vol. 11, No. 1, pp. 7-32.

Pamuk, Ş. (2006). Estimating Economic Growth in the Middle East since 1820. *The Journal of Economic History*, Vol. 66, No. 3, pp. 809-828.

Pamuk, Ş. (2016). Economic Growth in Southeastern Europe and Eastern Mediterranean, 1820-1914. *Economic Alternatives*, Vol. 22, No. 3, pp. 249-264.

Pamuk, Ş. (2018). Uneven Centuries: Economic Development of Turkey Since 1820. Princeton University Press, Princeton.

Pamuk, Ş. (2020). The Ottoman Empire: Institutions and Economic Change, 1500-1914. *Oxford Research Encyclopedias, Economics and Finance*.

Pan, C.-L. (1949). The Population of Libya. *Population Studies*, Vol. 3, No. 1, pp. 100-125.

Panzac, D. (1992) International and Domestic Maritime Trade in the Ottoman Empire during the 18th Century. *International Journal of Middle East Studies*, Vol. 24, No. 2, pp. 189-206.

Pejin, J. (2007). Great Hungarian caprice. Ekopres, Zrenjanin.

Qubain, F. Issa. (1955). Social Classes and Tensions in Bahrain. *The Middle East Journal*, Vol. 9, No. 3, pp. 269–280.

Rama, S. A. (2019). Nation Failure, Ethnic Elites, and Balance of Power: The International Administration of Kosova. Palgrave Macmillan, New York.

Rubin, J. (2017). Rulers, Religion, and Riches: Why the West Got Rich and the Middle East Did Not. Cambridge University Press, New York.

Rutherford, M. (2001). Institutional Economics: Then and Now. *The Journal of Economic Perspectives*, Vol. 15, No. 3, pp. 173-194.

Saleh, M. (2013). A Pre-Colonial Population Brought to Light: Digitization of the Nineteenth Century Egyptian Censuses. *Historical Methods: A Journal of Quantitative and Interdisciplinary History*, Vol. 46, No. 1, pp. 5-18.

Shami, S. (2009). Historical Processes of Identity Formation: Displacement, Settlement, and Self-Representations of the Circassians in Jordan. *Iran and the Caucasus*, No. 13, pp. 141-160.

Sokoloff, K. L. and Engerman, S. L. (2000). History Lessons: Institutions, Factor Endowments, and Paths of Development in the New World. *Journal of Economic Perspectives*, Vol. 14, No. 3, pp. 217-232.

Solow, R. M. (1956). A Contribution to the Theory of Economic Growth. *The Quarterly Journal of Economics*, Vol. 70, No. 1, pp. 65-94.

Van Zanden, J. L. (1995). Tracing the Beginning of the Kuznets Curve: Western Europe during the Early Modern Period. *The Economic History Review*, Vol. 48, No. 4, pp. 643-664.

Voigt, S. (2013). How (Not) to measure institutions. *Journal of Institutional Economics*, Vol. 9, No. 1, pp. 1-26.

Vora. N. and Koch, N. (2015). Everyday Inclusions: Rethinking Ethnocracy, Kafala, and Belonging in the Arabian Peninsula. *Studies in Ethnicity and Nationalism*, Vol. 15, No. 3, pp. 540-552.

Waterbury, J. (1999). The Long Gestation and Brief Triumph of Import-Substituting Industrialization. *World Development*, Vol. 27, No. 2, pp. 323-341.

Wikimedia Commons (2009). File: Middle East (orthographic projection).svg. Wikimedia
  Commons, the free media repository. Available online:
  https://commons.wikimedia.org/wiki/File:Middle_East_(orthographic_projection).svg
  [Accessed 23 May, 2023].

World Bank (n.d.). Arable land (% of land area). World Bank, World Development
  Indicators. Available online: https://data.worldbank.org/indicator/AG.LND.ARBL.ZS
  [Accessed 23 May, 2023].

Appendix

Table A.1 Non-Muslim Share of Population

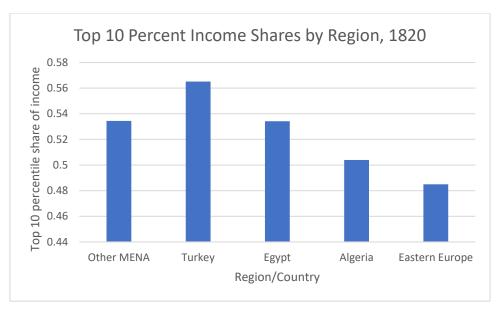| Country	Non-Muslim Share, ca. 1820	Non-Muslim Share, ca. 1870
Albania	0.321817353	0.321817353
Algeria	0.05	0.05
Bahrain	0.05	0.05
Bosnia and Herzegovina	0.631230208	0.631230208
Bulgaria	0.623874067	0.719784795
Cyprus	0.661140764	0.694444444
Egypt	0.1	0.115
Greece	0.806265068	0.819549769
Iraq	0.155606675	0.155606675
Israel-Palestine	0.126763638	0.126763638
Jordan	0.05	0.05
Kuwait	0.05	0.05
Lebanon	0.344621056	0.344621056
Libya	0.0	0.0
Montenegro	0.965706223	0.848562612
North Macedonia	0.677181142	0.608872215
Qatar	0.05	0.05
Romania	0.996697634	0.99249046
Saudi Arabia	0.0	0.0
Serbia	0.965731311	0.907817446
Syria	0.113503829	0.113503829
Tunisia	0.0	0.0
Turkey	0.141041931	0.220860672
Yemen	0.0	0.0

Source: see Table 4.1

Figure A.1 *Regional Top Income Shares in the Ottoman Empire, 1820*

Source: Chancel and Piketty (2021) data

Table A.2 *Top 10 Percent Incomes Shares*

Country	Top 10 Percent Income Share, 1820	Top 10 Percent Income Share, 1870
Albania	0.485	0.495
Algeria	0.504	0.527
Bahrain	0.5344	0.552
Bosnia and Herzegovina	0.485	0.495
Bulgaria	0.485	0.495
Cyprus	0.5344	0.552
Egypt	0.5342	0.554
Greece	0.485	0.495
Iraq	0.5344	0.552
Israel-Palestine	0.5344	0.552
Jordan	0.5344	0.552
Kuwait	0.5344	0.552
Lebanon	0.5344	0.552
Libya	0.5344	0.552
Montenegro	0.485	0.495
North Macedonia	0.485	0.495
Qatar	0.5344	0.552
Romania	0.485	0.495
Saudi Arabia	0.5344	0.552
Serbia	0.485	0.495
Syria	0.5344	0.552
Tunisia	0.5344	0.552
Turkey	0.5652	0.575
Yemen	0.5344	0.552

Source: Chancel and Piketty (2021) data

Table A.3 *Estimated GDP Per Capita in 2011 Dollars*

Country	GDP Per Capita, 1820	GDP Per Capita, 1870	GDP Per Capita, 1913
Albania	$369.2685714	$711	$1293
Algeria	$685	$1140	$1854
Bahrain	$956.4	$1115.8	$1434.6
Bosnia and Herzegovina	$456.0025397	$878	$1551
Bulgaria	$702.2912974	$1339	$2151.9
Cyprus	$1044.07	$1335.772	$1837.882
Egypt	$956	$1195	$1674
Greece	$1021.754	$1938	$2537.17788
Iraq	$877	$956	$1275
Israel-Palestine	$1036.1	$1354.9	$1912.8
Jordan	$877	$1116	$1594
Kuwait	$956.4	$1115.8	$1434.6
Lebanon	$1084	$1514	$2311
Libya	$973.934	$1185.936	$1630.662
Montenegro	$456.0025397	$878	$1551
North Macedonia	$456.0025397	$878	$1434.6
Qatar	$956.4	$1115.8	$767
Romania	$263.1905374	$362	$956
Saudi Arabia	$797	$829	$1833.1
Serbia	$456.0025397	$878	$2072
Syria	$1084	$1403	$1551
Tunisia	$685	$1009	$1407
Turkey	$974	$1165	$1473
Yemen	$973.934	$1185.936	$1630.662

Source: see text

Table A.4 *Descriptive Statistics for Variables*

Variable	N	μ	σ	Min	Max
$GDPGrowth_{i,1820-1870}$	24	0.0068526	0.0041847	0.0007876	0.0131892
$ArableLand_i$	24	0.156831	0.1372681	0.0005612	0.427759
$CoastAreaRatio_i$	24	0.0234673	0.0234673	0.0	0.2118421
$ShareNonMuslim_{i,1820}$	24	0.3283825	0.3564251	0.0	0.9966976
$ExtractRatio_{i,1820}$	24	1.043191	0.4894146	0.7346095	3.165064
$ln(GDPPC_{,1820})$	24	6.613252	0.4001677	5.572878	6.988413
$GDPGrowth_{i,1870-1913}$	24	0.0096503	0.0038393	0.0033203	0.0176148
$ShareNonMuslim_{i,1870}$	24	0.3279552	0.345096	0.0	0.9924905
$ExtractRatio_{i,1870}$	24	0.8445764	0.1783458	0.6210347	1.624506
$ln(GDPPC_{i,1870})$	24	6.967772	0.3183904	5.891644	7.569412
$GDPGrowth_{i,1820-1913}$	24	0.0081444	0.0038049	0.0019579	0.0150723

Source: see text

Table A.5 *OLS Regressions with Top 1 Percent Extraction Ratios, 1870-1913*

	Dependent variable: $GDPGrowth_{t-t+T}$		
	(1) $GDPGrowth_{1820-1870}$	(2) $GDPGrowth_{1870-1913}$	(2) $GDPGrowth_{1820-1913}$
$ArableLand_t$	0.00801	-0.00737	0.00157
	(0.00872)	(0.00950)	(0.00835)
$CoastAreaRatio_t$	-0.00580	-0.00813	-0.00557
	(0.0190)	(0.0189)	(0.0182)
$ShareNonMuslim_t$	-0.00257	0.00258	-0.000433
	(0.00399)	(0.00375)	(0.00383)
$ExtractRatio_t$	-0.00699**	-0.0104	-0.00564**
	(0.00261)	(0.00874)	(0.00250)
$ln(GDPPC_t)$	-0.0106**	-0.00327	-0.00757*
	(0.00441)	(0.00603)	(0.00423)
$Constant$	0.0848**	0.0430	0.0651**
	(0.0317)	(0.0494)	(0.0304)
N	24	24	24
R^2	0.326	0.194	0.251

Standard errors in parentheses
* p < 0.1, ** p < 0.05, *** p < 0.01

Table A.6 *OLS Regressions with Initial Level of GDP Per Capita, 1870-1913*

	Dependent variable: $GDPGrowth_{t-t+T}$		
	(1) $GDPGrowth_{1820-1870}$	(2) $GDPGrowth_{1870-1913}$	(2) $GDPGrowth_{1820-1913}$
$ArableLand_t$	0.00779	-0.00872	0.00134
	(0.00883)	(0.00938)	(0.00844)
$CoastAreaRatio_t$	-0.00626	-0.0106	-0.00612
	(0.0193)	(0.0190)	(0.0185)
$ShareNonMuslim_t$	-0.00200	0.00306	0.0000287
	(0.00393)	(0.00355)	(0.00376)
$ExtractRatio_t$	-0.00636**	-0.00836	-0.00526**
	(0.00259)	(0.00720)	(0.00248)
$GDPPerCapita_t$	-0.0000128**	-0.000000694	-0.00000902
	(0.00000567)	(0.00000434)	(0.00000542)
$Constant$	0.0233***	0.0181*	0.207***
	(0.00656)	(0.00987)	(0.00627)
N	24	24	24
R^2	0.311	0.188	0.238

Standard errors in parentheses
* p < 0.1, ** p < 0.05, *** p < 0.01

Table A.7 *Correlations Between Independent Variables, 1820*

	$ArableLand_{1820}$	$CoastAreaRatio_{1820}$	$ShareNonMuslim_{1820}$	$ExtractRatio_{1820}$	$ln(GDPPC_{1820})$
$ArableLand_{1820}$	1.0000				
$CoastAreaRatio_{1820}$	-0.1378	1.0000			
$ShareNonMuslim_{1820}$	0.6647	-0.0011	1.0000		
$ExtractRatio_{1820}$	0.4359	-0.1014	0.5146	1.0000	
$ln(GDPPC_{1820})$	-0.3619	0.2824	-0.6304	-0.8146	1.0000

Source: see text

Table A.8 *Correlations Between Independent Variables, 1870*

	$ArableLand_{1870}$	$CoastAreaRatio_{1870}$	$ShareNonMuslim_{1870}$	$ExtractRatio_{1870}$	$ln(GDPPC_{1870})$
$ArableLand_{1870}$	1.0000				
$CoastAreaRatio_{1870}$	-0.1378	1.0000			
$ShareNonMuslim_{1870}$	0.7113	0.0055	1.0000		
$ExtractRatio_{1870}$	0.2485	-0.1681	0.1989	1.0000	
$ln(GDPPC_{1870})$	-0.1746	0.2737	-0.2895	-0.8578	1.0000

Source: see text

Table A.9 *VIF for Regression Models with Multiple Independent Variables in Table 6.1*

Variable	Variance Inflation Factor			
	(1) VIF	(2) VIF	(3) VIF	(6) VIF
$ArableLand_{1820}$	2.19	1.88	1.02	
$CoastAreaRatio_{1820}$	1.25	1.08	1.02	
$ShareNonMuslim_{1820}$	3.11	2.09		
$ExtractRatio_{1820}$	3.41	1.45		2.97
$ln(GDPPC_{1820})$	4.65			2.97
Mean VIF	2.92	1.62	1.02	2.97

Source: see text

Table A.10 *VIF for Regression Models with Multiple Independent Variables in Table 6.2*

Variable	Variance Inflation Factor			
	(1) VIF	(2) VIF	(3) VIF	(6) VIF
$ArableLand_{1870}$	2.60	2.14	1.02	
$CoastAreaRatio_{1870}$	1.23	1.07	1.02	
$ShareNonMuslim_{1870}$	2.66	2.08		
$ExtractRatio_{1870}$	4.75	1.09		4.18
$ln(GDPPC_{1870})$	5.25			4.18
Mean VIF	3.30	1.59	1.02	4.18

Source: see text

Table A.11 *VIF for Regression Models with Multiple Independent Variables in Table 6.3*

Variable	Variance Inflation Factor			
	(1) VIF	(2) VIF	(3) VIF	(6) VIF
$ArableLand_{1820}$	2.19	1.88	1.02	
$CoastAreaRatio_{1820}$	1.25	1.08	1.02	
$ShareNonMuslim_{1820}$	3.11	2.09		
$ExtractRatio_{1820}$	3.41	1.45		2.97
$ln(GDPPC_{1820})$	4.65			2.97
Mean VIF	2.92	1.62	1.02	2.97

Source: see text