Armenian and Greek Legacy in Modern Turkish Development

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Abstract

Mass deportations of Armenian minorities from their historical homelands in the Ottoman Empire during the WWI and the Greek-Turkish population exchange of 1923 were the two major events of the early 20th century that permanently changed the ethno-religious landscape of Anatolia. These events marked the end of centuries-long coexistence of the Muslim populations with the two biggest non-Muslim communities in Anatolia. In this paper, we empirically investigate the legacy of the Armenian and Greek populations during the late Ottoman period on regional development in modern Turkey. In particular, we explore, at the sub-national level, the relationship between the historical Armenian and Greek presence, and several indicators of development including population density, urbanization, regional income and inequality. Findings suggest that locations with greater presence of Greek and Armenian minorities at the end of the 19th century are systematically more densely populated and urbanized, exhibit greater economic activity and greater inequality in land holdings today.

Keywords: Persistence; Economic Development; Religious minorities; Ethnicity; Armenians; Greeks.

JEL classification codes: O10, O43, P48, N40, Z12.

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1 Introduction

How can we evaluate the role of different ethno-religious groups in economic development? This paper aims to answer this question by focusing on the Armenian and Greek communities in the Ottoman Empire, whose members were expelled from their homelands in Anatolia en masse in the early 20th century. The forceful displacement of Armenians from their homelands and livelihoods following the onset of the First World War and the expulsion of Greek minorities after the Greco-Turkish War (1919-1922) virtually put an end to hundreds of years of cohabitation and socioeconomic interactions between Muslim and non-Muslim subjects of the Ottoman Empire.

The goal of this paper is to assess the long-run contribution of Armenians and Greeks to regional development in Anatolia by exploring empirically the legacy these groups left in modern Turkey. Historically, Armenian and Greek communities possessed higher levels of physical capital, had higher levels of education, and were disproportionately more represented in modern economic sectors (Ungor and Polatel, 2011; Kuran, 2004; Der Matossian, 2007; Kévorkian, 2011). Hence, they plausibly had a bigger impact on the development of their home regions than the Muslim subjects of the Empire. We investigate the persistence of this potential Armenian and Greek legacy. More specifically, we seek to answer the following question: Would the economic contribution of these minorities simply die out over time when the human capital embodied in their members is no longer an input to regional production? In other words, can we observe, even in today's outcomes, the influence of the physical capital these groups have accumulated until their departure or of the knowledge diffusion that possibly took place over the long period of co-existence with the Muslim majority? To offer an answer to this question, this study attempts to isolate the part of regional disparities in economic development today that resulted from the historical foundations laid by ethno-religious groups that are long gone.

By exploiting the sub-national variation in the size of Armenian and Greek communities and various proxies for economic development, we explore the relationship between historical non-Muslim minority presence and observable indicators of current regional development. We find that districts with greater Armenian and Greek concentration before the expulsions are today more densely populated, more urbanized and enjoy higher economic welfare as measured by the intensity of lights at night, a widely used proxy for economic activity when more direct indicators of development are not available at the local level. Moreover, consistent with our conjecture that the redistribution of confiscated minority properties must have led to greater inequality in the regions with higher historical presence of Armenian and Greek communities, we find a positive association between the population share of both groups and land inequality at the district level. Previous works by historians on the legacy of the Armenian and Greek populations of Anatolia have a qualitative nature and mostly focus on particular localities that were affected by the expulsions. To our knowledge, this paper is the first study documenting empirically the positive relationship between regional concentration of Ottoman Greeks and Armenians in Anatolia and subsequent Turkish development.

Various channels could be responsible for this legacy. Part of it could be directly attributed to inter-group differences in the accumulation of human capital and positive spill-overs of knowledge and entrepreneurial skills. Another channel could be the contribution of the productive assets, originally owned by non-Muslim minorities, to future economic development at the regional level. Historical accounts suggest that the minority capital that was transferred to the local elite might have played an important role during the emergence of a Muslim bourgeoisie and provided a foundation for the creation of a modern national economy (Kévorkian, 2011; Ungor and Polatel, 2011).

Any empirical evaluation of the persistence of the contribution of minorities in regional development is subject to several problems. Focusing on post-emigration outcomes in the source country may not be sufficient, because most migration happens voluntarily. The dynamics of a migration wave depend on the preferences, skills and economic opportunities (e.g. ethnic networks) of individual emigrants, and the resulting selection effects pose two main obstacles. First of all, the fact that some group members typically choose to stay implies that there is no marked end to a minority group's presence in all regions under study. This makes it impossible to disentangle the legacy of previous generations of émigrés from the effect of the remaining co-ethnics. Secondly, since the timings of voluntary migrations typically differ by region, so does the durations of treatment, i.e. the absence of group members in each region. Therefore, it is not possible to address the question of persistence using a single year to measure the outcomes in each region.

The historical setting we focus on makes our analysis largely immune to the aforementioned problems. Both Greeks and Armenians were forced to leave their homelands in Anatolia as a result of the official state policies which were partly motivated by the ongoing wars and partly by the ideological orientations of the ruling elite of the time. The mass expulsions of Armenians and Greeks took place around the same time period and they led to a virtually complete removal of these communities from all the regions of Anatolia in a matter of a couple of years (1915-1917 for Armenians and 1919-1923 for Greeks). Around 1893, Armenians and Greeks constituted about 8 and 10 percent of the Ottoman population in the territories that roughly correspond to Turkey today (Karpat, 1985). By 1927, however, more than 97 percent of Turkey's population was Muslim.[1] Hence, using the fact that none of the regions in our sample was spared from the expulsions, we are able to exploit sub-national variation in the presence of Armenian and Greek people of the late Ottoman period as a proxy for the long-run exposure of each region to minorities. This in turn allows us to explore the link between such exposure and various modern indicators of economic performance.

The mass killings and deportations of the Ottoman Armenians took place during 1915-1917 following the 'Temporary Law of Deportation' (Tehcir Law) issued by the Committee of Union and Progress (CUP) government. The number of Armenians who lost their lives during and following the deportations and the number of survivors in exile are subject to big controversies. While some historians put the number near to 850,000 (McCarthy, 2001), some other studies like Marashlian

[1] When Istanbul is excluded, this figure is as high as 99 percent.

(1991) argue that the Ottoman Armenian casualties should be close to 1.2 million. The survivors lived in exile for the rest of their lives with the exception of a relatively small number who were exempt from the deportations or managed to survive, taking refuge with Muslim families, hiding their identities or converting to Islam to escape the deportations.

The Greek-Turkish Population Exchange (the Asia Minor Catastrophe as it was commonly called in Greece) took place in 1923 after the two states signed the Convention Concerning the Exchange of Greek and Turkish populations. Including the Greek emigrants who fled, prior to the exchange agreement, from the destruction of the Greco-Turkish War, the mass migrations involved around 1.3 million Anatolian Greeks who were expelled from Anatolia and moved to Greece, and 354,000 Muslims who were expelled from Greece and resettled to Turkey (Hirschon, 2003).

These events are quite unique both in terms of the number of people involved and in the sense that only a negligible number of the expelled Armenians and Greeks returned –or managed to return– to Turkey.[2] Among those who survived, many chose to leave over the first couple of decades following the foundation of the Turkish Republic. What these unfortunate circumstances imply is that, unlike many other migration events, in our setting, return migration is not an issue that we need to account for in our empirical analysis.

Armenian and Greek expulsions not only brought death and suffering at catastrophic scales, but also caused much damage to the social and economic fabric of modern Turkey. Although anecdotal evidence and some macro-level statistics on the state of the economy in the aftermath of the war years abound,[3] it is difficult to separate the individual role of expulsions from the destructive forces of constant warship. Quantitative studies of Turkish economic development and regional income disparities such as Mutlu (2002) and Altug et al. (2008) have largely ignored the long-term consequences of the expulsions, primarily because of the lack of reliable and comparable regional data on relevant outcomes before and after the expulsions. It is important to note that this paper does not aim to evaluate the direct impact of the expulsions either, and our findings should not be interpreted as such. Instead, the positive correlations we document between past minority presence and contemporary development should be viewed as a suggestive evidence on the persistent Armenian and Greek legacy. Yet, we believe that our findings are, at least qualitatively, informative about the counterfactual trajectory Turkish economy might have followed if the expulsions had not happened.

Our paper speaks to a broad strand of literature on the persistent effects of historical events. In this literature, researchers have studied, for example, the economic and institutional consequences in Europe of the outbreak of the Black Death in the 1340s (Postan, 1973; North and

[2] One reason was the government law issued in May 1927 which authorized the exclusion of Turkish nationality to anyone who had not taken part in the War of Independence and had remained abroad between 24 July 1923 and 27 May 1927.

[3] According to the estimates reported in Eldem (1994), economic activity in many sectors slowed down substantially. The percentage declines were about 75 percent in coal production, 50 percent for draught animals, 40 percent for sheep and goats, 40 percent in wheat production, 50 percent in the tobacco, raisins, hazelnuts, olive oil, raw silk and cotton business, 80 percent in minerals and 50 percent in cotton textiles. Overall, GDP shrunk roughly by 40 percent.

Paul, 1973; Brenner, 1976), the effects of the 1840s Irish famine on emigration and industrialization (O'Rourke, 1994; Whelan, 1999; O Grada, 2000), the effects of the loss of life and economic damage caused by wars (Davis and Weinstein, 2002; Miguel and Roland, 2011), and the persistent effects of slavery and slave trade on sub-Saharan Africa (Law, 1991; Lovejoy, 2000; Nunn, 2008).

More specifically, this study contributes to the literature on the expulsion of minorities. For example, Grosfeld et al. (2013) find that the current residents of the areas of the Russian Empire known as the Pale of Settlement, outside of which Jews were not allowed to live, exhibit higher anti-market attitudes, lower entrepreneurship and higher trust compared to those residents outside the Pale of Settlement. In a similar spirit, we investigate what kind of legacy the historical minority presence left for the predominantly Muslim population that remained. Acemoglu et al. (2011) provide evidence on how the persecution, displacement and mass murder of Jews by the Nazis in the WW2 left a persistent impact on the social fabric and education of Russian cities. They show that cities where the Holocaust was more severe have worse economic and political outcomes than other cities. Our approach differs from theirs in that we do not view the deportations as a one-time historical shock whose direct short-term effect we would like to estimate. We conjecture that in the short-run there were negative repercussions. However, these adverse shocks are merely events that put an end to a centuries-long co-existence, and this long-term co-existence should have aggregate positive spillovers onto the rest of the population that last even after the originators are gone. Hence, our results should be interpreted as the accumulated legacy of co-existence with non-Muslim minorities.

This paper is also related to the role of overall human capital in development (Glaeser et al., 2004), and in particular the role of the human capital possessed by ethnic/religious minorities with different occupational specialization, higher education and skills (Botticini and Eckstein, 2007). For example, Waldinger's recent work focuses on interethnic spillovers, and investigates the effect of the expulsion of Jewish academics on German universities (Waldinger, 2012). Hornung (2014) studies the long-term effects of skilled-worker immigration on productivity for the case of Huguenots' migration to Prussia. He identifies causal effects of Huguenot settlement on the productivity of textile manufactories hundred years after their immigration. In our setting, one question of interest is whether part of the legacy of the non-Muslim minorities on current outcomes reflects human capital spillovers (know-how, expertise, entrepreneurial spirit, etc.) onto the Muslim population during the long co-existence of the two communities. If such spill-overs exist, one would expect their effect to be more salient during the course of the creation of a national economy that relies on the Muslim workforce, entrepreneurs, and farmers working on the productive assets and land left behind by the minorities, and in sectors, markets and occupations previously controlled by minorities. Therefore, the long co-existence of Muslims and non-Muslim minorities should have productive spillovers even after the minorities were gone, and this should positively affect the subsequent development of those localities with larger historical minority population.

Lastly, this paper contributes to the literature on regional development in Turkey and the income disparities between eastern and western parts of Turkey (Altug et al., 2008; Icduygu, 2009; Mutlu, 2002; Pamuk, 1987; Toprak, 2012).

The rest of the paper is organized as follows. The next section provides information about the economic position of Greeks and Armenians in the Ottoman Empire, the legal status of non-Muslim minorities, and offers a brief historical summary of the events leading up to deportations of the Armenians and the Greek-Turkish Population Exchange. Section 3 describes our data and the empirical methodology we employ. In Section 4 we present our results, and section 5 concludes the paper.

2 Historical Background

2.1 Minorities in the Ottoman Empire

From its foundation circa 1299 until its dissolution in 1922, the Ottoman Empire ranged from Asia Minor to the Balkans, to Maghreb and to the Arabic peninsula; and it ruled over ethnically and religiously heterogeneous peoples. As the Empire expanded and incorporated a greater number of diverse peoples, there emerged a need to institutionalize various groups into the empire in order to maintain peace and harmony.

After the conquest of Constantinople, which has historically been the center of the Orthodox Christian world, Sultan Mehmet II laid the foundation of the millet (community or nation) system. Under the millet system, non-Muslim subjects of the Ottoman Empire enjoyed a certain degree of autonomy and were allowed to rule themselves. Each minority group was organized into a separate millet and was free to elect its own religious leader. For example, Armenian Orthodox and Greek Orthodox millets were separate communities presided by their own Patriarchs. Shariah (the Islamic law) had no jurisdiction over non-Muslim minorities, on issues of business conduct for example, and any case among non-Muslims was tried according to their own law. In addition to legal autonomy, millets had the right to use their own language, control their own schools and churches, and collect taxes (Shaw, 1977; Sugar, 1977). Lastly, non-Muslims were not required to serve in the military by paying poll taxes, which might have worked in their advantage by allowing them to focus on their business.

Benefiting from their privileged legal and institutional position, non-Muslim minorities of the Empire thrived economically, and by the 19th century they had a disproportionate control over trade, commerce and finance (Kuran, 2004). Thus, compared to its Muslim subjects, Armenians and Greeks of the Ottoman Empire were at a relatively more advanced stage in their economic modernization. They were, on average, more educated, were engaged in higher value-added sectors in trade, agriculture and manufacturing, and owned greater wealth relative to their Muslim counterparts (Kuran, 2004; Der Matossian, 2007; Kévorkian, 2011).

For instance, in the Black Sea region Armenian and Greek merchants dominated the brokerage between Western and local traders as well as the procurement and the distribution

of goods. By the end of the 19th century, in the province of Trabzon, out of 33 exporters, three were Turks, one was Swiss, and the remaining 29 were Greek or Armenian, while out of 63 major importers, only 10 were Turkish (Kuran, 2004).[4] Also along the Aegean coast non-Muslims, especially Greeks, dominated commerce. Greeks constituted 40 to 60 percent of the merchants, although they formed 20 to 38 percent of the total population (Kuran, 2004). Similarly, in Istanbul, a predominantly Turkish city, Turks made up just 4 percent of export-import merchants by the time of First World War. Official statistics also confirm these numbers. According to the Ottoman yearbook of 1912, Muslims of the empire, 81 percent of the total population, not only had no role in trade with Europe, but also had a limited role in local trade. They made up 15 percent of local traders, while Armenians and Greeks made up 23 and 43 percent of local traders, respectively (Sonyel, 1993).

2.2 Expulsion of Minorities from the Empire

The Young Turk Committee of Union and Progress (CUP), mostly Muslim students, staged a coup and seized power from the Sultan Abdulhamid in 1908. Although CUP's initial reform-oriented agenda was to reinstitute a constitutional and parliamentary framework, it quickly set on a national homogenization path in the heat of external and internal tensions as the Empire disintegrated. As early as 1910s, a large-scale anti-Christian campaign ensued. Seeing an opportunity in the outbreak of First World War, Young Turks consolidated dictatorial powers and engaged in dechristianisation of Asia Minor. CUP classified the Ottoman populations and attempted at radical demographic engineering through resettlement, dispersion, expulsion and massacre. In April 1915, CUP embarked on a wholesale anti-Armenian extermination policy. First, Armenian elite, religious leaders and intellectuals were arrested. Then, Armenian populations of Anatolia and European Turkey were removed through massacres and death marches to the camps in Syrian desert. By the end of First World War, virtually all of around 1.5 million Armenians were removed from Asia Minor, most of them were killed and some fled (Akçam, 2013; Dundar, 2008).

Although Greek minorities of the Ottoman Empire also suffered from harassment, expulsion and killings during CUP's reign, it was not until 1923 that they were expelled from Asia Minor altogether. In the aftermath of the Turkish War of Independence and after the abolition of the Ottoman Empire in 1922, Greece and Turkey signed a peace agreement in Lausanne, which stipulated an exchange of the Muslim population in Greece for the Orthodox Greek population in Turkey. The 1923 Convention Concerning the Exchange of Greek and Turkish population forcibly removed about two million people from their homelands. By the end of 1920s, the population exchange programme had achieved its goal; the Greeks of Turkey were wiped out of the Turkish lands and were diminished to irrelevantly miniscule numbers (Friedman, 2006).

All in all, in the period starting with First World War and in its aftermath, Turkification of Asia Minor dramatically altered the demographics of Turkey and stripped it from virtually all of its Armenian and Greek inhabitants. In the 1893 census, Armenian and Greek shares in the total

[4] At the time, Greeks and Armenians made up 40 percent of Trabzon's population (Turgay, 1982).

population were about 8 and 10 percent, respectively, excluding Istanbul. However, by 1927, more than 99 percent of Turkey registered Muslim, excluding Istanbul.

3 Data and Empirical Methodology

3.1 Data

3.1.1 Data on Historical Armenian and Greek Populations

There are two potential sources for historical population of minorities. One is the Population Statistics of the Ottoman State in the year 1914, i.e. the year before the mass deportations started. The other source is the Ottoman General Census of 1881/82-1893.

The 1914 statistics were prepared by using the figures from the 1905/1906 census and adding births and subtracting deaths registered during the years in between. Various tribes in Eastern Anatolia could not be counted. The information on the population size of these tribes was based on estimates. For the purpose of our analysis, the major problem with the 1914 population figures is that in several regions of the Eastern and Southeastern Anatolia, the tensions between Armenians and the state forces have intensified during the final years of the reign of Sultan Abdulhamid II. Armenian national movement gained momentum in this period.[5] In some regions Armenians organized armed self-defense forces in response to attacks by Kurdish tribesmen and irregulars. Armenian revolutionary activity in the East and the ensuing violence was met with a heavy armed response by the central government. In the mid-1890s, several massacres took place against the Armenians in the eastern provinces of the Ottoman Empire. These massacres were carried out by irregular corps armed by the state and named Hamidian Regiments after the sultan. They led to 200,000 to 300,000 dead according to some estimates (Akçam, 2006). During this period, several regions in the East of Anatolia have been the stage of Armenian uprisings and clashes between Armenian militia and Ottoman Empire's forces including the Sasun Rebellion of 1894, the Zeitun Rebellion of 1895-1896 and the 1896 Defense of Van. The incidents continued in the immediate aftermath of the Young Turk Revolution of 1908. In April 1909, anti-Armenian pogroms in Adana Vilayet resulted in the deaths of as many as 20,000–30,000 Armenians (Adalian, 2010). The casualties caused by sporadic clashes between state forces and the Armenian rebels, the civilians who died during the massacres committed against Armenians over the period between 1894 and 1914, and the people who migrated elsewhere to escape from violence all make the 1914 population figures less suitable for an analysis of the long-term legacy of Armenian communities in Anatolia.[6]

[5] In the 1880s Armenian revolutionary parties increased their activities. Although these movements received little support from rural Armenian population, the state responded with radical measures that harmed the rural peasants.

[6] The picture is further complicated due to the fact that between 1854 and 1908 approximately 5 million Muslims immigrated from Russia (Caucasus, Crimea, Kuban, and Central Asia) and the Balkans to the Ottoman lands, while over the same period about 500,000 to 800,000 Greeks, Armenians, and Arabs emigrated, mainly to Russia and the Americas. Since the the immigrants were only reflected in the Ottoman statistics with a substantial time lag whereas the minorities who left were accounted for in a more timely fashion, in the regions where Muslim immigrants settled the Census statistics are more likely to understate the actual share of Muslims.

Therefore, for historical distribution of Armenian and Greek minorities across Anatolia, we use the population figures reported in the Ottoman General Census of 1881/82-1893 (1893 Census henceforth) (Karpat, 1985).[7] This census is the first Ottoman Census where not only male, but also female population of the Empire was counted.[8] Unlike the Muslim groups, who are lumped into one big category, the census classifies the non-Muslim population into various groups by nationality, ethnicity or religion including Greeks, Armenians, Jews, Bulgarians and other small minority groups. The population figures are reported at the level of *kaza* (district), which is the third level of administrative division after *vilayet* (province) and *sancak* (akin to county). Since we focus on the legacy of Armenian and Greek minorities on modern Turkish development, we leave out those Ottoman regions that are outside the contemporary boundaries of the Turkish Republic. Also, there are a few areas within the modern Turkish boundaries (Erzurum, Bitlis, Elaziz and Van), where the census counts were known to be incomplete mostly due to the practical difficulty of counting various nomadic tribes. Although the Ottoman statistical office reported the names of the specific vilayets, sancaks, and tribes for which counts were incomplete and provide population estimates for these areas, these estimates are unlikely to be reliable and they are not available at the district level. Rather than making arbitrary assumptions about how the estimated uncounted population was distributed across Ottoman districts within a given sancak/vilayet, we drop all modern districts that were mapped to Ottoman locations with incomplete Census counts. Since historical population data for areas that were under Russian occupation at the time of the census counts were not available, the Turkish provinces and districts that fall within these occupied territories are also excluded from the sample.

Mapping Ottoman kazas listed in the 1893 Census into modern Turkish administrative divisions is a challenging task. Although historical maps showing the borders of vilayets and sancaks are available, information about geographic boundaries for kazas is absent. This makes it impossible to employ spatial mapping techniques. Instead, we match Ottoman kazas with Turkish districts by name based on the Ottoman location names listed in Sezen (2006). This source documents how

[7]Karpat (1985) argues that the official Ottoman Census records should be deemed as the most reliable source of information about the Ottoman population. One reason is that these censuses were primarily designed to meet administrative and military needs, especially the need to acquire accurate information about the number of and age of the male population for the purposes of recruitment into a modern army. Karpat discusses in length some of the discrepancies and potential biases in the alternative sources of information. While it might be too far stretched to claim that the official censuses of the late Ottoman period present a completely unbiased picture of the non-Muslim presence in the Empire, there is no apparent reason to suspect that any bias in population figures for the minorities varied by region in a systematic way. The 1913-1915 population figures released by the Armenian Patriarchate put the total number of Armenians in the empire to well above the official Ottoman figures, the reliability of these figures were also questioned. Even if these figures were closer to the true numbers, they suffer from the same problem that make the 1914 Ottoman statistics unsuitable. More importantly, the statistics of the Patriarchate are confined to the Armenian community and hence they do not provide any information on the population of Muslims and other non-Muslim minorities.

[8]The Ottoman censuses were far from perfect. In some vilayets there was serious undercounting of women and children. In some regions, females were even totally excluded from the census count. Mutlu (2003) applies some corrections to the Census figures using Model Life Tables and reports the resulting lower- and upper-bound estimates. However, these estimates are only available at the level of Ottoman *vilayets*, making them less useful for a disaggregated analysis. Since these regions (Bagdat, Basra, and Musul Provinces and Ipek and Prizren Sancaks) remain outside the modern Turkish boundaries, missing female figures do not pose a problem for our analysis.

the administrative status and classification of each location evolved from the early Ottoman period until we reach the current administrative units of the Turkish Republic. This information allows us to search for the name of modern districts (*ilçe*) and identify which Ottoman kaza they used to belong to at the time the 1893 Census was conducted.[9] In most of the cases, an Ottoman kaza is either matched with a single or often times to multiple modern districts, as the former is usually geographically larger than the latter.[10] Our unit of observation is a modern district.

Figure 1 describes the geographical distribution of the Armenian and Greek populations in Ottoman Turkey as projected on the modern geography of Turkish administrative boundaries. The population shares reported for each modern district on the map reflect the historical shares of Armenians and Greeks in the Ottoman *kaza* to which the modern district was assigned.

The two maps not only document the cross-district and cross-regional variation in minority shares, but they also demonstrate the distinct patterns of settlement of the two groups. Armenians were heavily concentrated in their historic homelands in the eastern half of Anatolia, also called as the Western Armenia. Greeks, on the other hand, were more concentrated in the coastal regions in the west, the Thrace region in the northwestern end of Turkey and eastern part of the Black Sea coast.

3.1.2 Data on Outcome Measures

Turkish Population Censuses The first set of outcome measures are the levels of population and urbanization rates at the district level from the Turkish census of 2000. Urbanization rate is the share of district population living within the municipal boundaries that define the district centers. The 2000 Census allows us to investigate the persistent traces of the centuries long presence of Greek and Armenian populations in the Anatolian land, long after the short- and medium-run effects of the radical demographic shifts and adjustments of the early 20th century must have subsided.

In all regressions, we omit from the sample the Istanbul province, the capital of the Ottoman Empire since 1453 and by far the most populous province in modern Turkey. The first reason is that Istanbul is by far the most important historic center of economic activity and home to much larger Greek and Armenian communities than what would be representative of the other regions of the Ottoman Empire. While the role of minorities in the development of these major hubs of economic activity cannot be ignored, the socioeconomic disparity between Istanbul and the rest of

[9] For some modern districts, especially those that are established during the Turkish Republic in areas where there was no settlement during the Ottoman period, it was not possible to identify the kaza or sancak that contains these areas. For these districts, we relied on other sources (mainly web sites of the local state administrations and municipalities) offering information about the history of the district, including where in the Ottoman administrative hierarchy it used to belong. A couple of cases for which no reliable information can be obtained is left out of the sample

[10] After the one-way mapping process of modern districts into Ottoman kazas is complete, there were a few remaining kazas that were not assigned to any modern district. Searching through the Ottoman location names in Sezen (2006) we were able to identify which modern district they overlapped with or contained by. These exceptional cases involve a large modern district whose territory coincides with –or contain– multiple kazas.

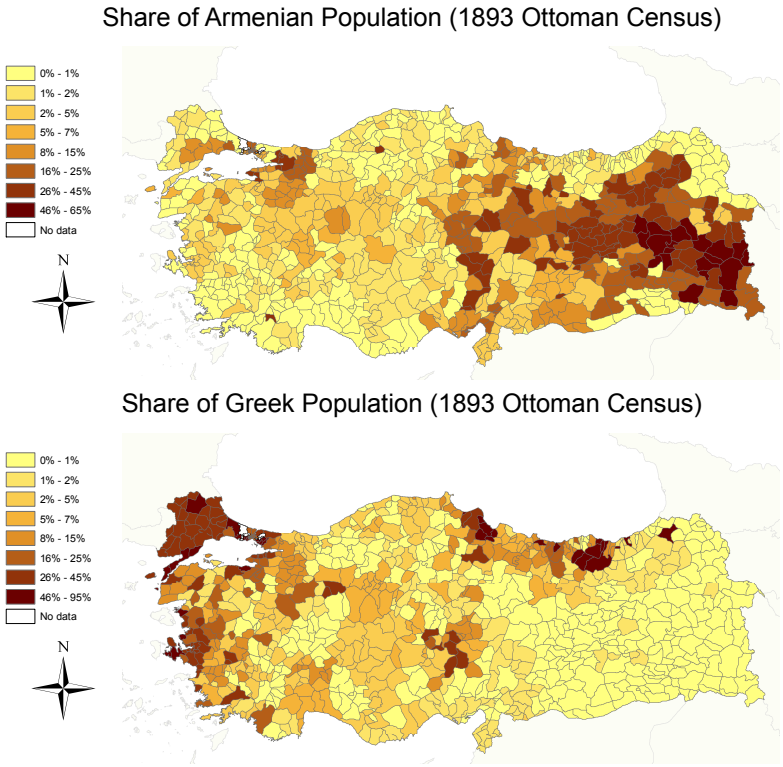

FIGURE 1: Minority Shares in the late 19th century Ottoman Empire

Turkey make the former highly influential in our empirical analysis.[11] The second reason is that the residents of Istanbul were exempt from the population exchange between Greece and Turkey as well as the deportation of Armenians.

Satellite Light Density at Night The subnational nature of our empirical study requires detailed spatial data on economic development. Existing measures of regional income for Turkey is only available at the level of province. In contrast, using satellite light density at night (or luminosity) as a proxy for local economic activity, we are able to exploit variation across more than 700 districts.[12] The luminosity data is obtained from the Defense Meteorological Satellite Program's

[11] Not surprisingly, including districts of Istanbul in the sample results in a noticeably larger positive correlation between historical minority presence and the indicators of development that we focus on. Therefore, by leaving Istanbul out of the sample, we stack the cards against finding a positive relationship.

[12] The use of satellite light density as a proxy of economic development builds upon previous studies, of which some prominent examples are Henderson et al. (2012), Michalopoulos and Papaioannou (2013), Elvidge et al. (1997), Doll et al. (2006) and Pinkovskiy (2013). These studies document a strong within-country correlation between luminosity and GDP levels and growth rates.

(DMSP) Operational Linescan System which reports images of the earth at night captured from 20:30 to 22:00 local time. The satellites detect lights from human settlements, fires, gas flares, lightning, and the aurora. Light density measure is a six-bit number (ranging from 0 to 63) calculated for every 30-second area (approximately 1 square kilometer). Overlaying all images captured during a calendar year, dropping images where lights are shrouded by cloud or overpowered by the aurora or solar glare (near the poles), and removing ephemeral lights like fires and lightning, an annual composite image of time-stable lights are created.[13] We construct a measure of average light density in 2000 at the district level, averaging across pixels that fall within district boundaries.

Figure 2 shows the strong positive correlation at the province level between GDP per capita and average luminosity in 2000, offering direct evidence that light density is a good proxy for local economic activity in the Turkish context.

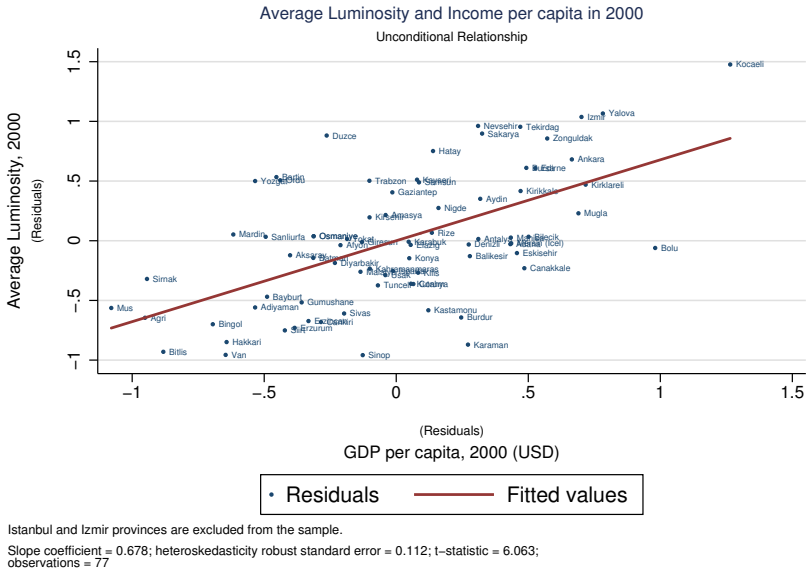

FIGURE 2: The relationship between province income and luminosity

3.1.3 Data on Control Variables

To account for potential exogenous factors that might have driven early Armenian and Greek settlement in economically more viable regions of Anatolia, we employ several geographical attributes as control variables. Using the ArcGIS software for spatial data manipulation and analysis, and digital maps, we construct several measures that might drive regional development. These control variables include latitude, longitude, and various other geographical attributes; namely adjacency to sea, lakes, major rivers, average elevation, ruggedness (measured as the standard deviation of

[13]Luminosity data are subject to saturation and blooming. Saturation occurs at a level of light density that is observed in rich urban centers. The corresponding pixels are top-coded with the maximum value of 63 assigned to each of them. Blooming occurs when the light intensity in some areas are perceived by satellites to be stronger than they actually are. This problem is more common for light sources near water and snowy areas.

elevation) and distance to nearest modern national border. In all regressions we also control for the total historical population of the Ottoman kaza or sancak in 1893.

Table 1 shows the summary statistics for all the variables we use in our empirical analysis.

TABLE 1: Summary Statistics

						Percentile	
	N	**Mean**	**SD**	**Min**	**Max**	**10th**	**90th**
Population density, 2000	765	155.48	620.11	3.94	11337.81	19.08	211.87
Urbanization rate, 2000	765	0.46	0.20	0.09	1.00	0.22	0.75
Average luminosity, 2000	765	3.77	5.83	0.02	54.64	0.58	7.22
Land holdings Gini	761	0.46	0.11	0.02	0.95	0.34	0.60
Armenian population, 1893	765	4086.81	8100.86	0.00	51096.00	0.00	10702.00
Greek population, 1893	765	6846.87	14713.35	0.00	77830.00	0.00	21286.00
Total population, 1893	765	61631.98	48346.75	3835.00	239073.00	18362.00	125329.00
Armenian share, 1893	765	0.06	0.11	0.00	0.65	0.00	0.20
Greek share, 1893	765	0.09	0.14	0.00	0.93	0.00	0.26
Longitude	765	33.39	4.40	25.91	44.17	27.66	39.66
Latitude	765	39.31	1.48	36.08	42.02	37.34	41.16
Average elevation (1/1000)	765	0.90	0.50	0.00	2.55	0.20	1.50
Ruggedness (1/1000)	765	0.24	0.15	0.00	0.91	0.09	0.42
Lake	765	0.29	0.45	0.00	1.00	0.00	1.00
Sea	765	0.22	0.41	0.00	1.00	0.00	1.00
Major river	765	0.28	0.45	0.00	1.00	0.00	1.00
log (distance to national border)	765	5.18	0.88	1.66	6.27	3.97	6.07
Railroad in 1910	765	0.18	0.38	0.00	1.00	0.00	1.00
Major 19th century port	765	0.02	0.15	0.00	1.00	0.00	0.00
In central kaza/sancak	765	0.42	0.49	0.00	1.00	0.00	1.00
log (Distance to war front), 1919-1922	765	4.16	1.28	-0.99	5.85	2.43	5.53
log (WW1 soldier casualty)	765	7.07	1.02	1.39	8.37	5.99	8.22
Immigrants settled during 1921-1929 (1/1000)	765	0.57	1.16	0.00	9.37	0.01	1.48

3.2 Empirical Framework

Our goal is to assess the relationship between the historical presence of Armenian and Greeks on the one hand and the contemporary outcomes on the other. Key to our identification is the fact that the deportation of Armenians in 1915-1916 and the Greek-Turkish population exchange of 1923 forced almost all the Armenian and Greek people of Anatolia to leave their centuries- long homelands over a very short time period and to settle in places outside Turkey. Given this fact, we use the size of Armenian and Greek populations prior to these dramatic events as a proxy for the long-term exposure of each district to minority presence.

We use two alternative measurements of minority presence. The first measure is the population size of Armenians and Greeks. The second is their share in the population. Which measure is more relevant presumably depends on the type of outcome we are interested in and what kind of a channel we have in mind when we think about the contribution of a centuries long Armenian and Greek presence to a region which no longer is home to these groups. For instance, the absolute scale (rather than merely the relative size) of the Armenian and Greek communities might have had an independent effect on development if, for example, there are economies of scale in the

accumulation of cultural capital or formation of ethnic networks that contribute to productivity. Also the productivity of religious minorities may be subject to threshold effects. On the other hand, if human capital spillovers between different ethno-religious groups are important, the opportunities and incentives for social and economic interactions across religious groups may matter for long-run productivity. A large Armenian minority that constitute a small fraction of a sizeable population in a region may have a different interaction with other groups, than a smaller Armenian group that constitutes a significant portion of the local population. Hence, depending on the context, the ethno-religious composition of a region may be more important for the outcomes we consider than the sheer size of the minorities. We start with an investigation of the role of minority population size and then move to regressions where the variable of interest is minority share. We first estimate the following equation using OLS

$$y_i = \beta_1 + \alpha_1 ln\left(armpop_{1893}\right)_{k_i} + \delta_1 ln\left(totpop_{1893}\right)_{k_i} + \theta_{\mathbf{1}}' \mathbf{X_i} + \varepsilon_i. \tag{1}$$

y_i is the modern outcome of interest (population density, urbanization or light density in 2000) for a modern district i. The independent variable of interest is the historical Armenian presence $armpop_{1893}$ in the Ottoman kaza (or sancak) k_i to which district i was assigned. Total population size $totpop_{1893}$ in k_i is included in the model not only as a scaling factor, but also to account for any direct legacy of the historical size of the kaza/sancak on contemporary outcomes. It can also be viewed as a proxy for initial economic conditions. Both population measures have a highly skewed distribution. Therefore, we use their logarithmic transformations. Since in several instances, multiple districts are assigned to a given Ottoman administrative unit, the 1893 figures for the Armenian population captures the exposure of district i to historical Armenian presence in kaza/sancak k_i as well as the exposure all other modern districts (if any) that are mapped to k_i, i.e., all j with $k_j = k_i$. In that sense, the coefficient of interest α_1 reflects the kaza/sancak level fixed effect of Armenians on modern district outcomes. Finally, $\mathbf{X_i}$ denotes the vector of geographical attributes we include in our baseline estimating equation.

The second model is simply a replication of the first model using the size of Greek minorities instead of the Armenian population, while the third baseline model includes both variables (Armenian and Greek populations) simultaneously.

$$y_i = \beta_2 + \gamma_2 ln\left(grepop_{1893}\right)_{k_i} + \delta_2 ln\left(totpop_{1893}\right)_{k_i} + \theta_{\mathbf{2}}' \mathbf{X_i} + \varepsilon_i. \tag{2}$$

$$y_i = \beta_3 + \alpha_3 ln\left(armpop_{1893}\right)_{k_i} + \gamma_3 ln\left(grepop_{1893}\right)_{k_i} + \delta_3 \ln\left(totpop_{1893}\right)_{k_i} + \theta_{\mathbf{3}}' \mathbf{X_i} + \varepsilon_i. \tag{3}$$

4 Empirical Results

4.1 Minorities and Contemporary Population Density

Our first outcome measure is the population density of a district in 2000. We view population density as an indicator reflecting the degree of economic opportunities and the capacity to sustain higher concentrations of people. Albeit a highly noisy proxy for development, population density is a good starting point in our attempt to understand the potential legacy of minorities on current demographic patterns.

Table 2 presents the results. Panel A and panel B present the partial correlation of population density with the size of Armenian and Greek populations, respectively. The models in panel C include Armenians and Greeks simultaneously. In each panel, we start with a specification that include historical population variables and a set of dummies for each of the seven geographic regions of Turkey.[14] In the second column, we add latitude and longitude and continue expanding the model with the remaining set of geographical controls until we reach column 5. In the last column we replace the modern region dummies with 21 geographic subregion dummies to obtain our baseline model. In all regressions, reported standard errors are clustered at the level of the smallest administrative unit for which we have data on minority populations. In almost the entire sample, this unit has a *kaza* status, and in a small number of cases the clustering unit has a *sancak* status (e.g. Gene Sancak in Bitlis Province).[15] Unless stated otherwise, we report the changes in outcomes variables that correspond to increasing our variable of interest from 10th to the 90th percentile of its cross-district distribution in the sample.

Moving to results in panel A, Armenian population in 1893 appears as a positive and statistically significant correlate of district population density in 2000 in all specifications. Specifically, the estimated coefficient from the baseline model in the last column suggests that a move in the size of the Armenian population from the 10th to the 90th percentile of its cross-regional distribution[16] is associated with an increase in population density by almost 43 percent, a relationship that is statistically significant at the 1 percent level.

The results for Greeks presented in panel B are qualitatively similar. The baseline results indicate that moving from 10th to the 90th percentile of the Greek population size distribution,[17] the population density is estimated to increase by about 38 percent from its sample mean. The relationship is statistically significant at the 5 percent level.

[14]These regions are the Marmara, Mediterranean, Aegean, Black Sea, Middle Anatolia, Eastern Anatolia and Southeastern Anatolia. They are not administrative regions. When defining them geographers considered similarity of provinces with respect to geographical factors such as climate, vegetation, presence of mountain ranges, and also some economic factors such as demographics, transportation and type of products cultivated.

[15]Since most of the time Ottoman kazas are assigned to multiple modern districts, our choice of clustering unit allows for arbitrary correlation of disturbance terms across districts that are assigned to the same kaza.

[16]This move corresponds to raising the size of the Armenian population in an Ottoman kaza from zero to about 10,700. The average kaza had around 4,086 Armenian inhabitants.

[17]This move corresponds to raising the size of the Greek population in an Ottoman kaza from zero to about 21,300. The average kaza had around 6,850 Greek inhabitants.

TABLE 2: Historical Minority Population Size and Population Density in 2000

	Log (Population Density in 2000)					
PANEL A	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	OLS	OLS	OLS
Log Armenian population, 1881-1893	0.054***	0.048**	0.042***	0.050***	0.047***	0.046***
	[0.020]	[0.021]	[0.015]	[0.015]	[0.014]	[0.013]
Log total population, 1881-1893	-0.014	0.015	0.026	0.011	0.016	0.087
	[0.113]	[0.119]	[0.099]	[0.095]	[0.095]	[0.085]
Observations	765	765	765	765	765	765
Adjusted R-squared	0.073	0.075	0.280	0.312	0.312	0.349
Effect of increasing independent variable	50.099***	44.847**	39.409***	46.752***	44.024***	42.701***
from the 10-th to the 90-th percentile	[18.666]	[19.136]	[14.250]	[13.669]	[13.437]	[12.005]

	Log (Population Density in 2000)					
PANEL B	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	OLS	OLS	OLS
Log Greek population, 1881-1893	0.088***	0.090***	0.053***	0.045**	0.048**	0.038**
	[0.022]	[0.022]	[0.019]	[0.019]	[0.019]	[0.017]
Log total population, 1881-1893	-0.054	-0.034	0.028	0.042	0.036	0.132
	[0.103]	[0.110]	[0.099]	[0.099]	[0.100]	[0.085]
Observations	765	765	765	765	765	765
Adjusted R-squared	0.100	0.108	0.284	0.309	0.312	0.346
Effect of increasing independent variable	87.686***	89.357***	52.346***	44.501**	47.345**	37.743**
from the 10-th to the 90-th percentile	[21.687]	[21.574]	[19.054]	[18.581]	[18.832]	[16.901]

	Log (Population Density in 2000)					
PANEL C	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	OLS	OLS	OLS
Log Armenian population, 1881-1893	0.041**	0.033*	0.034**	0.043***	0.039***	0.038***
	[0.019]	[0.019]	[0.015]	[0.014]	[0.013]	[0.014]
Log Greek population, 1881-1893	0.081***	0.084***	0.046**	0.035**	0.039**	0.027
	[0.021]	[0.021]	[0.018]	[0.017]	[0.018]	[0.017]
Log total population, 1881-1893	-0.124	-0.093	-0.031	-0.033	-0.030	0.060
	[0.106]	[0.113]	[0.101]	[0.101]	[0.101]	[0.086]
Observations	765	765	765	765	765	765
Adjusted R-squared	0.109	0.113	0.290	0.317	0.319	0.351
Effect of increasing the size of Armenian population	38.008**	30.528*	31.179**	39.956***	35.752***	35.357***
from the 10-th to the 90-th percentile	[17.459]	[17.267]	[13.528]	[12.705]	[12.398]	[12.615]
Effect of increasing the size of Greek population	80.753***	83.327***	45.703**	35.352**	38.394**	27.239
from the 10-th to the 90-th percentile	[20.811]	[20.824]	[18.070]	[17.209]	[17.755]	[17.107]
Modern region dummies	✓	✓	✓	✓	✓	
Modern subregion dummies						✓
Longitude & Latitude		✓	✓	✓	✓	✓
Average Elevation & Ruggedness			✓	✓	✓	✓
Lake, sea and major rivers				✓	✓	✓
Distance to national border (km)					✓	✓

When both the Armenian and Greek population size are entered simultaneously Armenian population appears significant at the 1 percent level, albeit the predicted change in population density is somewhat smaller (35 percent at the mean).[18] The coefficient on Greek population size remains positive but insignificant at conventional levels with a p-value of 0.11.

The fact that the estimated coefficients of interest are stable and there are no sizable differences across different columns is reassuring in the sense that selection on geographical attributes do not seem to be a major problem in our context. Clearly, the results should be interpreted with caution as they do not imply causation as we cannot rule out the possibility that selection of Armenian and Greek minorities occurred in the distant past on some unobservable factors that make some regions economically more lucrative than others.

4.2 Minorities and Contemporary Urbanization Rates

Our second outcome measure is urbanization rate in a district in 2000. It shows the fraction of district population living within the borders that define district centers. One can view this measure as containing more specific information about the degree of economic modernization. Historically, Greeks and Armenians were more urbanized than the Muslim subjects of the Ottoman Empire. If due to their occupational specializations these groups were attracted to more urbanized central districts in the Ottoman territory, one would expect this selection effect to manifest itself as higher urbanization today, despite the fact that these minorities no longer live in these locations. However, persistence of initial conditions does not preclude the possibility that regional disparity in these conditions might be the outcome of long-term presence of Greek and Armenian communities and their contribution to economic development. Many provinces and districts that are significantly more urbanized today were possibly not so much ahead of other regions at some distant past, prior to the settlement of first Greek and Armenian groups. Therefore, the evidence in Table 3 can be interpreted in two different ways, and which interpretation plays a more significant role is hard to tell without controlling for the selection story.

Moving to results, we see that districts with higher historical exposure to Armenian presence are significantly more urbanized even after controlling for the baseline geographical variables. The coefficient estimates from the baseline models in column 6 of panel A and C suggest that, keeping other variables constant, a move from 10th to the 90th percentile of the regional distribution of Armenian population is associated with an increase in urbanization rate by about 8 to 9 percentage points, a change that is statistically significant at the 1 percent level.

The evidence on Greeks is qualitatively similar, but less robust. The positive association between Greek population size and urbanization rate in panel B –with an estimated change of 6.7 percentage point in urbanization rate under the baseline model– is significant at the 5 percent level, but it does not survive when we include the size of the Armenian population (panel C).

[18] It is important to highlight that the estimates in the baseline model reflect the average partial correlations that are driven by variations within 21 subregions.

TABLE 3: Historical Minority Population Size and Urbanization Rate in 2000

PANEL A	**Urbanization Rate in 2000**					
	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
Log Armenian population, 1881-1893	0.007**	0.007**	0.006**	0.007**	0.008**	0.010***
	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
Log total population, 1881-1893	0.014	0.012	0.014	0.012	0.011	0.018
	[0.018]	[0.020]	[0.018]	[0.018]	[0.018]	[0.017]
Observations	765	765	765	765	765	765
Adjusted R-squared	0.020	0.019	0.054	0.058	0.058	0.082
Effect of increasing independent variable	6.321**	6.492**	5.848**	6.519**	6.998**	9.045***
from the 10-th to the 90-th percentile	[2.893]	[3.073]	[2.786]	[2.787]	[2.721]	[2.863]

PANEL B	**Urbanization Rate in 2000**					
	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
Log Greek population, 1881-1893	0.009***	0.009***	0.006*	0.006*	0.006*	0.007**
	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
Log total population, 1881-1893	0.013	0.011	0.016	0.016	0.016	0.030*
	[0.018]	[0.019]	[0.018]	[0.018]	[0.018]	[0.017]
Observations	765	765	765	765	765	765
Adjusted R-squared	0.025	0.024	0.054	0.056	0.055	0.076
Effect of increasing independent variable	8.913***	9.134***	6.401*	5.967*	5.879*	6.747**
from the 10-th to the 90-th percentile	[3.365]	[3.355]	[3.358]	[3.371]	[3.466]	[3.301]

PANEL C	**Urbanization Rate in 2000**					
	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
Log Armenian population, 1881-1893	0.006*	0.005*	0.005*	0.006**	0.007**	0.008***
	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
Log Greek population, 1881-1893	0.008**	0.008**	0.005*	0.005	0.004	0.004
	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
Log total population, 1881-1893	0.004	0.002	0.007	0.006	0.005	0.014
	[0.019]	[0.020]	[0.019]	[0.019]	[0.019]	[0.017]
Observations	765	765	765	765	765	765
Adjusted R-squared	0.028	0.028	0.057	0.060	0.059	0.083
Effect of increasing the size of Armenian population	5.127*	5.096*	4.883*	5.619**	6.059**	7.855***
from the 10-th to the 90-th percentile	[2.726]	[2.867]	[2.664]	[2.664]	[2.613]	[2.902]
Effect of increasing the size of Greek population	7.978**	8.127***	5.361*	4.680	4.362	4.413
from the 10-th to the 90-th percentile	[3.169]	[3.143]	[3.182]	[3.195]	[3.319]	[3.284]
Modern region dummies	✓	✓	✓	✓	✓	
Modern subregion dummies						✓
Longitude & Latitude		✓	✓	✓	✓	✓
Average Elevation & Ruggedness			✓	✓	✓	✓
Lake, sea and major rivers				✓	✓	✓
Distance to national border (km)					✓	✓

4.3 Minorities and Contemporary Economic Development as Measured by Luminosity

4.3.1 Historical Minority Population Size and Regional Development

Our third and main outcome variable is luminosity, i.e., average light intensity measured from satellite images at night. While certainly a noisy measure that does not capture economic prosperity in its entirety, it nonetheless is a good proxy for economic development, albeit, mostly driven by industrial activity, urbanization and urban infrastructure than by agricultural activity. In light of previous results on population density and urbanization, one would expect to see also a positive relationship between minority presence and luminosity. The evidence in Table 4 corroborates this expectation. Both Armenian and Greek presences are highly significant and positive predictors of economic development. The estimated magnitudes are economically meaningful. Raising the size of Armenian population from 10th to the 90th percentile of its cross-regional distribution is associated with an increase in average district luminosity by almost 57 percent at the sample mean (column 6 in panel A). When conditioned on the level of Greek population, the magnitude falls to 45 percent, still a large increase given that Armenians were a minority group that constituted about 8 percent of a total of almost 17.4 million people that were counted in the 1893 Census. Based on the unconditional relationship between luminosity and GDP per capita, –estimated at the province level and shown in Figure 2– a 45 percent increase in luminosity corresponds to an increase in regional GDP per capita by about 22.5 percent (or $535 per capita in 2000 US dollars).

Panel B shows the results for Greek population. The estimated relationship between the historical population size of Greeks and mean luminosity is positive and significant at the 1 percent level. The coefficient estimate is slightly larger in magnitude than for the case of Armenian population. A move from 10th to the 90th percentile in the population distribution implies an increase in luminosity by 58.6 percent. When we control for Armenian population in panel C, Greek population size still remains a highly significant predictor of economic development, although the estimated magnitude is somewhat lower and very close to the corresponding change for Armenians. Average luminosity is higher by 45 percent (at the mean) when we move from 10th to the 90th percentile of the Greek population distribution. In units of regional GDP, again, this chance roughly corresponds to an increase in income per capita by $535.

4.3.2 Historical Minority Shares and Regional Development

In Table 5 we use minority population shares as an alternative to absolute population size. The estimated models are otherwise identical to those in Table 4. We do not view the results presented here as being part of a robustness analysis, but rather of a different analysis whereby the variable of interest reflects another demographic dimension, namely the relative size of different ethno-religious groups.

The baseline results suggest that a move from 10th to the 90th percentile of the cross-regional distribution of Armenian population share is associated with an increase in mean luminosity

TABLE 4: Historical Minority Population Size and Average Luminosity in 2000

PANEL A	Average Luminosity in 2000					
	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
Log Armenian population, 1881-1893	0.056***	0.053**	0.041**	0.050***	0.050***	0.062***
	[0.021]	[0.022]	[0.017]	[0.015]	[0.016]	[0.015]
Log total population, 1881-1893	-0.023	-0.021	0.010	-0.010	-0.010	-0.013
	[0.110]	[0.115]	[0.092]	[0.091]	[0.091]	[0.084]
Observations	765	765	765	765	765	765
Adjusted R-squared	0.097	0.096	0.307	0.348	0.348	0.392
Effect of increasing independent variable	51.852***	49.766**	37.951**	46.322***	46.340***	57.304***
from the 10-th to the 90-th percentile	[19.275]	[20.540]	[15.696]	[14.402]	[14.585]	[13.529]

PANEL B	Average Luminosity in 2000					
	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
Log Greek population, 1881-1893	0.101***	0.103***	0.072***	0.064***	0.065***	0.059***
	[0.021]	[0.021]	[0.020]	[0.019]	[0.019]	[0.016]
Log total population, 1881-1893	-0.081	-0.082	-0.024	-0.012	-0.015	0.033
	[0.098]	[0.101]	[0.089]	[0.090]	[0.090]	[0.084]
Observations	765	765	765	765	765	765
Adjusted R-squared	0.137	0.141	0.326	0.357	0.357	0.391
Effect of increasing independent variable	101.028***	103.190***	71.546***	63.592***	65.066***	58.651***
from the 10-th to the 90-th percentile	[21.194]	[20.744]	[19.638]	[18.506]	[18.508]	[16.368]

PANEL C	Average Luminosity in 2000					
	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
Log Armenian population, 1881-1893	0.041**	0.036*	0.028*	0.038***	0.037**	0.048***
	[0.019]	[0.020]	[0.016]	[0.015]	[0.015]	[0.015]
Log Greek population, 1881-1893	0.094***	0.097***	0.066***	0.055***	0.057***	0.045***
	[0.020]	[0.019]	[0.019]	[0.017]	[0.017]	[0.016]
Log total population, 1881-1893	-0.150	-0.145	-0.073	-0.079	-0.078	-0.059
	[0.102]	[0.105]	[0.093]	[0.094]	[0.093]	[0.085]
Observations	765	765	765	765	765	765
Adjusted R-squared	0.146	0.147	0.329	0.364	0.363	0.400
Effect of increasing the size of Armenian population	37.756**	33.159*	26.068*	35.667***	34.164**	45.103***
from the 10-th to the 90-th percentile	[17.935]	[18.595]	[15.050]	[13.561]	[13.762]	[13.708]
Effect of increasing the size of Greek population	94.142***	96.641***	65.993***	55.425***	56.513***	45.251***
from the 10-th to the 90-th percentile	[19.523]	[19.365]	[18.699]	[16.961]	[17.240]	[15.909]
Modern region dummies	✓	✓	✓	✓	✓	
Modern subregion dummies						✓
Longitude & Latitude		✓	✓	✓	✓	✓
Average Elevation & Ruggedness			✓	✓	✓	✓
Lake, sea and major rivers				✓	✓	✓
Distance to national border (km)					✓	✓

TABLE 5: Historical Minority Population Shares and Average Luminosity in 2000

PANEL A	**Average Luminosity in 2000**					
	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
Armenian population share, 1881-1893	0.528	0.382	0.819*	0.931**	0.917**	0.971*
	[0.562]	[0.588]	[0.481]	[0.451]	[0.453]	[0.498]
Log total population, 1881-1893	0.087	0.087	0.087	0.086	0.085	0.103
	[0.111]	[0.113]	[0.086]	[0.082]	[0.083]	[0.085]
Observations	765	765	765	765	765	765
Adjusted R-squared	0.080	0.080	0.302	0.340	0.339	0.379
Effect of increasing independent variable	10.515	7.595	16.297*	18.531**	18.248**	19.325*
from the 10-th to the 90-th percentile	[11.183]	[11.710]	[9.580]	[8.965]	[9.020]	[9.908]

PANEL B	**Average Luminosity in 2000**					
	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
Greek population share, 1881-1893	1.952***	1.932***	1.255***	1.060***	1.243***	1.199***
	[0.456]	[0.461]	[0.369]	[0.353]	[0.383]	[0.381]
Log total population, 1881-1893	0.060	0.066	0.079	0.080	0.076	0.128*
	[0.094]	[0.099]	[0.081]	[0.080]	[0.081]	[0.075]
Observations	765	765	765	765	765	765
Adjusted R-squared	0.129	0.129	0.318	0.348	0.351	0.389
Effect of increasing independent variable	50.462***	49.931***	32.442***	27.408***	32.122***	31.001***
from the 10-th to the 90-th percentile	[11.793]	[11.917]	[9.526]	[9.137]	[9.888]	[9.847]

PANEL C	**Average Luminosity in 2000**					
	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
Armenian population share, 1881-1893	0.759	0.658	0.978**	1.088**	1.059**	1.001**
	[0.587]	[0.619]	[0.485]	[0.463]	[0.452]	[0.475]
Greek population share, 1881-1893	2.000***	1.976***	1.312***	1.136***	1.307***	1.210***
	[0.444]	[0.451]	[0.349]	[0.332]	[0.366]	[0.365]
Log total population, 1881-1893	0.058	0.060	0.069	0.068	0.065	0.098
	[0.092]	[0.096]	[0.077]	[0.077]	[0.078]	[0.077]
Observations	765	765	765	765	765	765
Adjusted R-squared	0.132	0.131	0.323	0.355	0.357	0.392
Effect of increasing the share of Armenian population	15.107	13.089	19.457**	21.655**	21.067**	19.916**
from the 10-th to the 90-th percentile	[11.689]	[12.315]	[9.655]	[9.204]	[8.992]	[9.446]
Effect of increasing the share of Greek population	51.709***	51.068***	33.908***	29.375***	33.779***	31.288***
from the 10-th to the 90-th percentile	[11.479]	[11.646]	[9.024]	[8.587]	[9.448]	[9.443]
Modern region dummies	✓	✓	✓	✓	✓	
Modern subregion dummies						✓
Longitude & Latitude		✓	✓	✓	✓	✓
Average Elevation & Ruggedness			✓	✓	✓	✓
Lake, sea and major rivers				✓	✓	✓
Distance to national border (km)					✓	✓

by 19 to 20 percent (panel A and panel C), while the corresponding change in luminosity for Greeks stands around 31 percent (panel B and panel C). Unlike the minority *size* regressions presented in the previous section, where the coefficient estimates for Greeks and Armenians were very similar, it appears that for minority *shares* the predicted percentage changes in luminosity are noticeably larger for Greeks than for Armenians. Also, the Greek share is statistically more significant with a t-statistic of 3.3 than the Armenian share whose coefficient has a t-statistic of 2.1.

4.3.3 Minorities and Economic Development: Robustness Analyses

In this section we perform several robustness checks to demonstrate that the significant results we presented in the previous section are not simply due to the omission of potential determinants of economic prosperity today. All robustness analyses for the population size regressions in Table 4 are presented in Table 6. First column in each panel simply replicates the baseline estimates shown in the last column of Table 4. In subsequent columns, we conduct various robustness checks that will be discussed below.

Access to Railroads and Ports. One concern is that those regions with greater access to railroads or major ports in the past might have developed earlier than others. Clearly, railroad construction is not random. The locations on the railroad network and the exact path it follows depends on economic potential of the waypoints it connects as well as the topography of the region. This is as much true for contemporary rail networks as for the railroads in the past. However, since we do not want to control for any indirect causal effect of minorities on current development, we choose to control for access to railroads as further in the past as possible. Using maps showing the historical rail network around 1910, we construct a railroad dummy that takes a value of 1 when a railroad goes through a given district, and zero otherwise. To measure access to sea trade we use a dummy which takes a value of 1 when a given district lies within within 20 km of a major 19th century port.[19] In column 2, we control for these two variables. Both of them enter the model with a significant coefficient and with an expected sign. Access to railroad in 1910 has a particularly strong and robust relationship with economic development in 2000. Reassuringly, the coefficient on Armenian population size remains significant both in the presence of Greek population size (panel C) and without it (panel A). However, the estimated magnitude is somewhat smaller compared to the baseline results shown in column 1. A move from 10th to the 90th percentile of the Armenian population distribution corresponds to an increase in average luminosity by 42.5 percent instead of 57.3 percent. Results are qualitatively similar for Greeks, but the fall in the estimated magnitudes is more moderate. Once access to railroads and major ports is controlled for, the estimated change in luminosity in response to an increase in the variable of interest from 10th to the 90th percentile, is reduced only by 7.7 percentage points, i.e., from 58.6 percent down to 50.9 percent (panel B).

The reductions in the coefficients on minority populations reflect the fact that, other things equal, both the Armenians and Greeks (though to a lesser extent) were systematically more likely

[19] These major ports are situated in Istanbul, Trabzon, Mersin, Iskenderun, Samsun and Izmir.

to live in districts with easier access to railroads and major ports, and this correlation seems to be responsible for part, but not all, of the reduced-form relation between minority size and contemporary development we document in Table 4.

TABLE 6: Historical Minority Population Size and Average Luminosity in 2000: Robustness to Historical Correlates of Economic Development

	Average Luminosity in 2000					
PANEL A	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
Log Armenian population, 1881-1893	0.062***	0.046***	0.062***	0.063***	0.056***	0.044***
	[0.015]	[0.015]	[0.015]	[0.015]	[0.015]	[0.015]
Log total population, 1881-1893	-0.013	-0.042	-0.021	-0.048	-0.084	-0.117
	[0.084]	[0.077]	[0.082]	[0.077]	[0.100]	[0.090]
Railroad in 1910		0.547***				0.528***
		[0.110]				[0.105]
Major 19th century port		0.848**				0.700**
		[0.334]				[0.330]
Distance (km) to war front, 1919-1922			0.062			0.058
			[0.055]			[0.052]
WW1 soldier casualty			0.094*			0.057
			[0.054]			[0.054]
Immigrants settled during 1921-1929				0.166***		0.101*
				[0.057]		[0.052]
In central kaza/sancak					0.185*	0.143
					[0.111]	[0.116]
Observations	765	765	765	765	765	765
Adjusted R-squared	0.392	0.437	0.396	0.405	0.396	0.446
Effect of increasing independent variable	57.304***	42.519***	57.902***	58.227***	51.922***	40.600***
from the 10-th to the 90-th percentile	[13.529]	[13.549]	[13.765]	[13.661]	[13.756]	[13.853]
Modern subregion dummies	✓	✓	✓	✓	✓	✓
Baseline geographical controls	✓	✓	✓	✓	✓	✓

	Average Luminosity in 2000					
PANEL B	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
Log Greek population, 1881-1893	0.059***	0.051***	0.059***	0.055***	0.052***	0.044***
	[0.016]	[0.016]	[0.016]	[0.016]	[0.016]	[0.015]
Log total population, 1881-1893	0.033	-0.022	0.026	0.009	-0.031	-0.079
	[0.084]	[0.073]	[0.082]	[0.077]	[0.100]	[0.088]
Railroad in 1910		0.567***				0.549***
		[0.107]				[0.104]
Major 19th century port		0.868**				0.739**
		[0.357]				[0.351]
Distance (km) to war front, 1919-1922			0.045			0.047
			[0.055]			[0.052]
WW1 soldier casualty			0.114**			0.072
			[0.054]			[0.053]
Immigrants settled during 1921-1929				0.150**		0.089*
				[0.059]		[0.053]
In central kaza/sancak					0.167	0.120
					[0.109]	[0.113]
Observations	765	765	765	765	765	765
Adjusted R-squared	0.391	0.440	0.395	0.402	0.394	0.447
Effect of increasing independent variable	58.651***	50.951***	59.254***	55.172***	51.563***	44.308***
from the 10-th to the 90-th percentile	[16.368]	[16.412]	[16.079]	[16.184]	[15.834]	[15.485]
Modern subregion dummies	✓	✓	✓	✓	✓	✓
Baseline geographical controls	✓	✓	✓	✓	✓	✓

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PANEL C	Average Luminosity in 2000					
	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
Log Armenian population, 1881-1893	0.048***	0.034**	0.049***	0.051***	0.046***	0.035**
	[0.015]	[0.014]	[0.015]	[0.015]	[0.015]	[0.015]
Log Greek population, 1881-1893	0.045***	0.042***	0.046***	0.041***	0.040***	0.036**
	[0.016]	[0.016]	[0.016]	[0.016]	[0.015]	[0.015]
Log total population, 1881-1893	-0.059	-0.084	-0.067	-0.088	-0.106	-0.135
	[0.085]	[0.079]	[0.084]	[0.079]	[0.098]	[0.090]
Railroad in 1910		0.540***				0.523***
		[0.108]				[0.104]
Major 19th century port		0.835**				0.700**
		[0.353]				[0.343]
Distance (km) to war front, 1919-1922			0.053			0.050
			[0.054]			[0.051]
WW1 soldier casualty			0.107**			0.070
			[0.054]			[0.053]
Immigrants settled during 1921-1929				0.156***		0.095*
				[0.057]		[0.052]
In central kaza/sancak					0.136	0.099
					[0.109]	[0.114]
Observations	765	765	765	765	765	765
Adjusted R-squared	0.400	0.444	0.404	0.412	0.402	0.451
Effect of increasing the size of Armenian pop.	45.103***	31.403**	45.495***	47.107***	42.496***	32.194**
from the 10-th to the 90-th percentile	[13.708]	[13.435]	[13.862]	[13.753]	[13.895]	[13.778]
Effect of increasing the size of Greek pop	45.251***	41.962***	45.496***	41.044***	40.238***	35.750**
from the 10-th to the 90-th percentile	[15.909]	[16.129]	[15.581]	[15.650]	[15.313]	[15.113]
Modern subregion dummies	✓	✓	✓	✓	✓	✓
Baseline geographical controls	✓	✓	✓	✓	✓	✓

Exposure to War. Late 19th and early 20th centuries were a period of constant warfare for the Ottoman Empire. Ottoman Empire took part in WW1 alongside the Central Powers of Germany and Austria-Hungary. Following the defeats in several fronts (except in the Dardanelles campaign) the Ottoman Empire disintegrated. Much of its non-Anatolian territory came under the control of Allied powers as protectorates. Meanwhile, in the Turkish core of Anatolia, that was not occupied by the Allied powers, the Turkish National Movement mobilized a large scale resistance to foreign occupation, culminating in the Turkish War of Independence (1919-1923). This war ended with the victory of the Turkish National Movement and led to the signing of the Treaty of Lausanne in July 1923 and the recognition of the sovereignty of the Republic of Turkey as the successor to the Ottoman Empire. Both the WW1 and the War of Independence had devastating consequences for the peoples of Anatolia both in terms of human casualties and material destruction.

Therefore, one potential concern about the baseline results is the possibility that regions that were more affected by the destructive forces of war might have fallen behind other regions on their way to recovery. Although destruction of physical capital and infrastructure is unlikely to have a direct negative effect that would persist well into year 2000, the loss of human capital due to migrations spurred by warfare and battle-related deaths might plausibly have left a trace on regional development trajectories.

We use two measures to control for exposure to war. One is the number of Ottoman soldiers who died in battle during the WW1. Using information on soldiers' birth province, we assign to each

district the corresponding number of casualties in the province containing that district. The second variable is the distance to nearest war front in the Turkish War of Independence. Of course, both of these variables might be endogenous to historical correlates of regional development. For example, soldier participation in WW1 could partly be determined by distance to battle fronts, geographic isolation as well as the capacity of the Ottoman government to recruit soldiers and punish defectors. Similarly, location of war fronts may depend on several logistical factors including local support, resource availability as well as the strategic priorities of occupying forces. Therefore, estimates on these control variables are likely to be biased.

Column 3 in Table 6 reports the results conditional on our war exposure measures. Distance to war fronts over the period 1919-1922 has no statistically discernible relationship with average luminosity in 2000. Contrary to our expectations, regions with higher number of WW1 soldier casualties enjoy significantly higher economic development in 2000. While this is hard to reconcile with a reasonable causal story, endogenous participation in war due to the aforementioned mechanisms might be part of the explanation. What is more important is that the estimated coefficients on both the Armenian and Greek populations remain significant at the 1 percent level and appear extremely stable when compared to those reported for the baseline model in column 1.

Settlement of Immigrants. Late 19th and early 20th centuries have witnessed the decline and the eventual collapse of the Ottoman Empire. Therefore, this period was inevitably also a period of involuntary migrations. Many Turkish (Turkic) and Muslim peoples from the Balkans, Caucasus, Crimea (Crimean Tatar diaspora) and Crete were forced to leave their homes and settle in present-day Turkey.

In particular, prior to the Armenian deportations of 1915-1916 and the Greek-Turkish population exchange, there were two major waves of immigration of Muslim populations of the Balkans into what is now the territory of the Turkish Republic. The first wave was triggered by the Russo-Turkish War (1877-1878) which was fought between the Ottoman Empire and the Eastern Orthodox coalition led by the Russian Empire and composed of several Balkan countries. The second wave came with the first Balkan War (1912-1913) between the Ottoman Empire and the Balkan League (Serbia, Greece, Montenegro and Bulgaria). Ottoman Empire experienced a heavy defeat resulting in the loss of almost all of its remaining European territory. Thousands of Muslims fleeing from the conflict and the assimilation policies of the newly independent Balkan nations took refuge in the Ottoman land.

Over the course of the Greco-Turkish War (1919-1922), the majority of the Ottoman Greeks already fled along with the retreating Greek Army. The population exchange between Turkey and Greece in 1923 simply formalized an ongoing de facto expulsion of the Greeks from Anatolia and the influx of about 350,000 Muslims from Greece into Turkey.

Many of the Muslim immigrants moved or were resettled by the government into locations that were once inhabited by Armenians and Greeks. This poses a challenge in terms of disentangling the long-run impact of minorities on current outcomes from the potential effect of incoming Muslim

migrants that replaced them. One way to partially address this issue is to explicitly account for the regional distribution of immigrants who settled after the departure of Armenians and Greeks.

Although we do not have disaggregate data on the settlement patterns of the Muslim immigrants who came in the early 1910s, we do have information on the number of immigrants that settled in Turkish provinces over the period 1921-1929. To construct district-level predictions, we assume that arriving immigrants were settled in such a way that population distribution across districts within receiving provinces were not altered due to the migrations. In other words, we take the cumulative number of immigrants to each province during 1921-1929 and distribute them across districts in that province based on the fraction of province population in 1927 that lived in each district.

In column 4 of Table 6, we control for the total predicted number of immigrants in each district between 1921-1929. This variable significantly predicts mean luminosity in year 2000, lending suggestive evidence for the conventional wisdom that, in the long-run, Muslim immigrants had a positive contribution to the economic development of the Turkish Republic. Reassuringly, both Armenian and Greek population sizes remain significant at the 1 percent level. Even more crucially, comparing columns 1 and 4, the estimated magnitudes for minority population size appear quite stable.

Historical Regional Centers. One may question whether our results are biased due to a systematic self-selection of Armenian and/or Greek communities into historically more central and urbanized locations where trade and manufacturing were relatively more important. Indeed, such systematic selection is quite likely and consistent with historical evidence. While today some of these regional centers of economic activity might have lost its previous significance, many of them plausibly remained as important economic centers and retained their economic lead vis-a-vis other locations in their near periphery. To mitigate this problem, in column 5 of Table 6 we control for a dummy that takes the value 1 for modern districts that were assigned to the central *kaza* (merkez *kaza*) of a given Ottoman *sancak* (the administrative unit that is one level above *kaza*) and zero otherwise.[20] The coefficient on this indicator has a positive sign, but it is insignificant except in panel A where Armenian size is the only variable of interest. In all panels, the population size of Armenian and Greeks remains highly significant. The predicted changes in luminosity –reported at the bottom of each panel– in response to higher minority presence are somewhat smaller in percentage terms, but they do not wildly differ from the baseline magnitudes.

Finally, in the last column of Table 6, all robustness controls are added to the baseline model simultaneously. The main conclusions about minority presence remains unchanged. Both Greek and Armenian population size (conditional on total *kaza* population) are positive and significant predictors of economic development. Assuming the presence of a causal link, we consider the magnitudes reported in column 6 of panel C as lower bounds for the influence of historical Armenian and Greek presence on regional development. According to these estimates, a region that was at

[20]The absence of a better historical proxy for economic potential and urbanization makes it difficult to carry out a more refined robustness analysis.

the 90th percentile of the Armenian population size distribution prior to the deportations was, on average, 16 percent richer in year 2000 than an otherwise identical region without any Armenians. The corresponding difference for Greeks is almost 18 percent.

Robustness checks for minority share regressions. In Table 7 we repeat the same robustness checks using the historical shares of Armenians and Greeks as our variable of interest, and we obtain qualitatively similar results.

TABLE 7: Historical Minority Shares and Average Luminosity in 2000: Robustness to Historical Correlates of Economic Development

	Average Luminosity in 2000					
PANEL A	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
Armenian population share, 1881-1893	0.971*	0.852*	0.959*	1.111**	0.888*	0.884*
	[0.498]	[0.461]	[0.490]	[0.484]	[0.509]	[0.460]
Log total population, 1881-1893	0.103	0.037	0.098	0.066	0.001	-0.059
	[0.085]	[0.071]	[0.081]	[0.073]	[0.105]	[0.088]
Railroad in 1910		0.578***				0.556***
		[0.109]				[0.106]
Major 19th century port		0.909***				0.755**
		[0.332]				[0.332]
Distance (km) to war front, 1919-1922			0.061			0.060
			[0.056]			[0.052]
WW1 soldier casualty			0.086			0.046
			[0.055]			[0.054]
Immigrants settled during 1921-1929				0.170***		0.101*
				[0.060]		[0.054]
In central kaza/sancak					0.233**	0.176
					[0.112]	[0.118]
Observations	765	765	765	765	765	765
Adjusted R-squared	0.379	0.430	0.382	0.393	0.385	0.441
Effect of increasing independent variable	19.325*	16.957*	19.085*	22.104**	17.668*	17.595*
from the 10-th to the 90-th percentile	[9.908]	[9.176]	[9.754]	[9.638]	[10.136]	[9.152]
Modern subregion dummies	✓	✓	✓	✓	✓	✓
Baseline geographical controls	✓	✓	✓	✓	✓	✓

	Average Luminosity in 2000					
PANEL B	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
Greek population share, 1881-1893	1.199***	0.874**	1.180***	1.042***	1.103***	0.708*
	[0.381]	[0.378]	[0.369]	[0.367]	[0.413]	[0.384]
Log total population, 1881-1893	0.128*	0.066	0.122*	0.101	0.035	-0.022
	[0.075]	[0.065]	[0.073]	[0.068]	[0.100]	[0.089]
Railroad in 1910		0.576***				0.557***
		[0.108]				[0.105]
Major 19th century port		0.770**				0.660*
		[0.368]				[0.360]
Distance (km) to war front, 1919-1922			0.043			0.051
			[0.055]			[0.053]
WW1 soldier casualty			0.103*			0.062
			[0.055]			[0.055]
Immigrants settled during 1921-1929				0.140**		0.084
				[0.058]		[0.052]
In central kaza/sancak					0.206*	0.164
					[0.116]	[0.120]
Observations	765	765	765	765	765	765
Adjusted R-squared	0.389	0.434	0.391	0.398	0.394	0.443
Effect of increasing independent variable	31.001***	22.587**	30.512***	26.935***	28.519***	18.296*
from the 10-th to the 90-th percentile	[9.847]	[9.762]	[9.542]	[9.474]	[10.664]	[9.934]

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Modern subregion dummies	✓	✓	✓	✓	✓	✓
Baseline geographical controls	✓	✓	✓	✓	✓	✓

	Average Luminosity in 2000					
PANEL C	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
Armenian population share, 1881-1893	1.001**	0.873*	0.976**	1.118**	0.929*	0.893**
	[0.475]	[0.445]	[0.467]	[0.469]	[0.487]	[0.449]
Greek population share, 1881-1893	1.210***	0.884**	1.187***	1.046***	1.119***	0.713*
	[0.365]	[0.365]	[0.352]	[0.345]	[0.396]	[0.366]
Log total population, 1881-1893	0.098	0.040	0.094	0.066	0.012	-0.045
	[0.077]	[0.066]	[0.074]	[0.067]	[0.100]	[0.087]
Railroad in 1910		0.565***				0.548***
		[0.109]				[0.106]
Major 19th century port		0.777**				0.663*
		[0.367]				[0.355]
Distance (km) to war front, 1919-1922			0.048			0.054
			[0.055]			[0.052]
WW1 soldier casualty			0.092*			0.052
			[0.054]			[0.054]
Immigrants settled during 1921-1929				0.148**		0.091*
				[0.058]		[0.052]
In central kaza/sancak					0.195*	0.155
					[0.117]	[0.122]
Observations	765	765	765	765	765	765
Adjusted R-squared	0.392	0.437	0.395	0.403	0.397	0.445
Effect of increasing Armenian population share	19.916**	17.379**	19.420**	22.245**	18.483*	17.762**
from the 10-th to the 90-th percentile	[9.446]	[8.858]	[9.297]	[9.325]	[9.697]	[8.938]
Effect of increasing Greek population share	31.288***	22.842**	30.673***	27.026***	28.922***	18.426*
from the 10-th to the 90-th percentile	[9.443]	[9.432]	[9.095]	[8.920]	[10.224]	[9.466]
Modern subregion dummies	✓	✓	✓	✓	✓	✓
Baseline geographical controls	✓	✓	✓	✓	✓	✓

The positive relationship between the shares of both groups and the level of economic development in 2000 proxied by average luminosity is robust to accounting for (i) access to historical railroad network and to major ports in the 19th century, (ii) casualties in the Ottoman army during WW1 and distance to fronts during the Turkish War of Independence, (iii) the size of the immigrant waves over 1921-1929 and (iv) proximity to central districts of the Ottoman Empire. Controlling for these different groups of variables separately (columns 2 to 5), we see that luminosity has a stronger relation to Greek share than to Armenian share, a pattern that mirrors the baseline results in Table 5. This gap however becomes negligible, once we add all the robustness controls together (panel C).

In general terms, the main concern about identification is that the positive relation between minority size and economic development might be partly driven by the persistence of initial conditions that are not necessarily a legacy of minority presence, but rather some 'deep' attributes on which there was differential self-selection across ethno-religious groups. In this section, we have attempted to address the most likely problems related to identification. Therefore, the results presented in Table 6 strengthen our confidence in the robustness of the positive legacy of Greeks and Armenians.

4.4 Minorities and Inequality in Contemporary Land Holdings

The results from the previous sections support the common wisdom that over many centuries prior to their expulsion, Armenian and Greek communities played an important role in shaping the regional patterns of development in Anatolia. The empirical evidence we have provided so far have revealed positive correlations between population density, urbanization and economic development (measured by luminosity) on the one hand, and the regional concentration of the two largest non-Muslim groups in the Ottoman Empire on the other. We view these findings as potentially reflecting the persistent influence of the higher rate of physical and human capital accumulation among the non-Muslim subjects of the empire. Investigation of the possible channels is an ongoing work. This section describes one piece of evidence which we believe can inform this investigation.

After the Armenian deportations and the Greek-Turkish Population Exchange, some of the properties that Armenians and Greeks had to leave behind and their productive assets such as land plots, shops and factories were plundered by the local people or captured by the influential elites of the region. In most part, these properties were confiscated by the state and were eventually sold to the public through auctions, and most of the time, for way below their real value (Ungor and Polatel, 2011).[21]

Using a simple theoretical model such as the one given in the appendix, one can demonstrate that under a wide range of reasonable scenarios regarding the post-expulsion transfer of minority assets (like land) among the remaining local population and the potential immigrants that arrive, asset inequality (as measured by Gini index) in a region increases with the share of minorities in the population. If, as predicted by the model, following the deportations and the population exchange, asset inequality was indeed more pronounced in regions with higher historical share of Armenians and Greeks, then we should see the impact of these historical shocks to inequality to persist or perhaps even become magnified over time.

Using district-level information on land holdings of households in 1997 we investigate whether the expulsion of Armenian and Greek minorities had any persistent effect on inequality in land holdings.[22] In the first column of Table 8 we reestimate our baseline specifications, this time

[21] On 27 September 1915, Talaat Pasha, then the Minister of Interior and the Minister of Finance of the government, drafted a "temporary law" titled "The law about the abandoned properties, debts and credits of the population who were sent elsewhere". With the directive of this law special commissions known as the "Abandoned Property Commissions" (Emval-i Metruke Idare Komisyonları) and the "Liquidation Commissions" (Tasfiye Komisyonu) were established. These commissions were tasked with collecting detailed information about the assets the deportees had to leave behind and assessing their value. Later on, the post-WW1 parliament rejected the deportation and the abandoned properties laws as a violation of the Ottoman constitution. In 1920 the Istanbul Government ruled by Ali Riza ordered by decree that the Armenian properties that were liquidated through war-time regulations should be returned. However, over the period 1922-1925, a series of laws passed first by the Ankara government of the Turkish national independence movement and then by the parliament of the newly established Turkish Republic re-instituted the legal foundation for the liquidation and redistribution of the minority assets (Ungor and Polatel, 2011).

[22] The ideal way to test the inequality hypothesis would be to use historical data on inequality at the regional level for the aftermath of the expulsions. Such data is unfortunately not available. Systematic records of confiscated properties and how they were distributed among the local Muslims are, to our knowledge, also not available to researchers.

using a Gini index for land holdings of households in a district as our outcome variable. In the subsequent columns, we check the robustness of the baseline findings to additional controls.

TABLE 8: Historical Minority Shares and Contemporary Land Inequality

	Land Holding Gini in 1997					
PANEL A	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
Armenian population share, 1881-1893	0.123**	0.112**	0.119**	0.126**	0.122**	0.112**
	[0.050]	[0.050]	[0.050]	[0.049]	[0.051]	[0.050]
Log total population, 1881-1893	0.002	0.003	0.002	0.001	0.001	0.002
	[0.006]	[0.006]	[0.006]	[0.006]	[0.009]	[0.009]
Railroad in 1910		0.034***				0.033***
		[0.009]				[0.009]
Major 19th century port		-0.049***				-0.052***
		[0.019]				[0.018]
Distance (km) to war front, 1919-1922			-0.001			-0.000
			[0.004]			[0.004]
WW1 soldier casualty			0.006			0.005
			[0.007]			[0.007]
Immigrants settled during 1921-1929				0.004		0.003
				[0.004]		[0.005]
In central kaza/sancak					0.002	0.000
					[0.011]	[0.012]
Observations	759	759	759	759	759	759
Adjusted R-squared	0.226	0.236	0.225	0.226	0.225	0.233
Modern subregion dummies	✓	✓	✓	✓	✓	✓
Baseline geographical controls	✓	✓	✓	✓	✓	✓

	Land Holding Gini in 1997					
PANEL B	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
Greek population share, 1881-1893	0.108***	0.119***	0.111***	0.108***	0.109***	0.121***
	[0.028]	[0.029]	[0.028]	[0.027]	[0.028]	[0.029]
Log total population, 1881-1893	0.005	0.006	0.005	0.005	0.005	0.007
	[0.007]	[0.006]	[0.006]	[0.007]	[0.009]	[0.009]
Railroad in 1910		0.034***				0.033***
		[0.008]				[0.009]
Major 19th century port		-0.069***				-0.070***
		[0.012]				[0.011]
Distance (km) to war front, 1919-1922			-0.003			-0.001
			[0.004]			[0.004]
WW1 soldier casualty			0.008			0.007
			[0.007]			[0.007]
Immigrants settled during 1921-1929				0.000		0.001
				[0.004]		[0.004]
In central kaza/sancak					-0.000	-0.002
					[0.011]	[0.012]
Observations	759	759	759	759	759	759
Adjusted R-squared	0.230	0.243	0.230	0.229	0.229	0.240
Modern subregion dummies	✓	✓	✓	✓	✓	✓
Baseline geographical controls	✓	✓	✓	✓	✓	✓

	Land Holding Gini in 1997					
PANEL C	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
Armenian population share, 1881-1893	0.126***	0.116**	0.120**	0.127***	0.126***	0.113**
	[0.048]	[0.048]	[0.048]	[0.047]	[0.048]	[0.048]
Greek population share, 1881-1893	0.110***	0.120***	0.112***	0.108***	0.111***	0.122***
	[0.028]	[0.030]	[0.028]	[0.027]	[0.028]	[0.029]
Log total population, 1881-1893	0.001	0.003	0.001	0.001	0.002	0.004
	[0.006]	[0.006]	[0.006]	[0.006]	[0.009]	[0.009]
Railroad in 1910		0.032***				0.031***
		[0.009]				[0.009]
Major 19th century port		-0.068***				-0.069***
		[0.011]				[0.012]

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Distance (km) to war front, 1919-1922			-0.002			-0.001
			[0.004]			[0.004]
WW1 soldier casualty			0.006			0.006
			[0.007]			[0.007]
Immigrants settled during 1921-1929				0.001		0.001
				[0.004]		[0.004]
In central kaza/sancak					-0.002	-0.003
					[0.011]	[0.012]
Observations	759	759	759	759	759	759
Adjusted R-squared	0.236	0.247	0.235	0.235	0.235	0.244
Modern subregion dummies	✓	✓	✓	✓	✓	✓
Baseline geographical controls	✓	✓	✓	✓	✓	✓

Our findings are consistent with the inequality hypothesis. A move from 10th to the 90th percentile in the cross-regional distribution of the share of Armenians before the deportations is associated with 2.46 percentage points –or 2.2 standard deviations– increase in the land Gini coefficient. The corresponding change for the Greek population is 2.16 percentage points –about 2 standard deviations. In all specifications, both of our variables of interest are significant at the 5 percent level or below, and the estimated magnitudes remain highly stable as we add different sets of controls for robustness.

5 Concluding Remarks

This paper offers preliminary evidence suggesting that the centuries-long presence of the two largest non-Muslim minorities of the Ottoman Empire might have significantly shaped the regional patterns of Turkish development and land inequality. In particular, we find that regions with greater minority population (both in absolute and relative terms) about a century ago exhibit higher population density, higher urbanization and higher night-time light density in 2000. We also establish that inequality in land holdings within each region in 1997 is also systematically related to minority presence before the expulsions.

In our ongoing work we aim to address several issues and carry out several extensions to the existing analysis. First of all, it is crucial to understand whether the correlations we document reflect the persistence of the initial differences in regional development that were *caused* by the historical settlement patterns of the minorities centuries ago, or whether they merely capture the persistence of some even deeper initial conditions that had shaped both the settlement patterns of Armenians and Greeks while also contributing *independently* to current development. To rule out this selection story and account for the endogeneity of the minority presence we work on constructing various potential instruments.

Assuming that the correlations we report indicate the causal effect of minority presence, the next question is whether this effect was driven by a faster rate of physical capital accumulation by these minorities or the indirect impact of knowledge –or human capital– diffusion prior to the expulsions. Hence, our other goal is to explore the importance of potential channels through which Armenian and Greek presence might have shaped the regional outcomes. In particular, we would like to assess whether there is any systematic evidence of a transfer of Armenian and Greek

human capital to Muslim co-residents in the same localities, through the transmission of production techniques, occupational know-how and specific craftsmanship skills.

Appendices

A Minority Share and Post-expulsion Asset Inequality

In this appendix section, we lay out a simple model of asset redistribution from an expelled minority group (which is relatively more wealthy than the majority group) to the remaining population and the potential new immigrants. Our aim is to demonstrate the positive relationship between minority population share and the degree of resulting asset inequality after such redistribution.

Consider two ethno-religious groups $j = m, n$ in a given region. m stands for Muslims and n stands for the non-Muslim minority group. There are two periods ($t = 1, 2$). $t = 1$ denotes the period before the expulsion of the minority group. In period 2 the minority group is expelled, Muslim immigrants of size n_2^i settle in the region.

In period 1, total population size is given by N_1, and out of this population n_1^n number of people belong to the non-Muslim group, and the rest of the people constitute the local Muslims. We denote the shares of each group in the population in period 1 by $\lambda_1^n = n_1^n/N_1$ and $\lambda_1^m = 1 - \lambda_1^n$. Total population size in period 2 is given by $N_2 = (1 - \lambda_1^n)N_1 + n_2^i$.

The value of immovable assets per member in each group $j = m, n$ and each period $t = 1, 2$ is given by y_t^j. For convenience we assume that each member of group n has the same quantity of period 1 assets. To keep things simple, we also assume that, in period 2, all members of n are expelled from the region and all of their immovable assets are confiscated. Hence, $\lambda_2^n = 0$ and $y_2^n = 0$.

The assets that group n leaves behind is equal to $A = n_1^n y_1^n$. These are divided among the local Muslims and the new immigrants. We allow the emergence of three potential groups in period 2 which are defined by their asset holdings after the transfer.

Part of the confiscated property is allocated to the Muslim immigrants that arrived after the expulsion. Let us denote the amount of this state transfer to each immigrant by y_2^i. Assuming –for simplicity– that immigrants arrive without any property this transfer is at same time equal to the value of per capita assets of the immigrants. Hence, immigrants constitute one of the three groups in period 2 with an asset per capita of y_2^i and a population share of

$$\lambda_2^i = n_2^i/N_2 = \frac{n_2^i/N_1}{1 - \lambda_1^n + n_2^i/N_1} = \frac{1}{1 + \frac{(1-\lambda_1^n)}{n_2^i/N_1}} \tag{4}$$

The remaining assets are captured by (or auctioned to) local Muslims. Only s^e fraction of the local Muslims (e.g. those that have political connections) are able to get a share from A.

Hence, the remainder of minority property after the transfers to immigrants are deducted is equally divided among an influential local elite of size $s^e(N_1 - n_1^n)$. These people constitute the rich local Muslims of period 2 and their share in the population in period 2 is given by

$$\lambda_2^{rl} = \frac{s^e(N_1 - n_1^n)}{N_2} = \frac{s^e(N_1 - n_1^n)}{(1-\lambda_1^n)N_1 + n_2^i} = \frac{s^e(1-\lambda_1^n)}{(1-\lambda_1^n) + n_2^i/N_1} = \frac{s^e}{1 + \frac{n_2^i/N_1}{(1-\lambda_1^n)}}. \tag{5}$$

Asset per person in this group is equal to whatever they had in the first period plus the amount they obtain from the division of remaining minority property:

$$y_2^{rl} = y_1^m + \frac{\lambda_1^n N_1 y_1^n - n_2^i y_2^i}{s^e(N_1 - n_1^n)} = \frac{s^e(1-\lambda_1^n)y_1^m + \lambda_1^n y_1^n - \frac{n_2^i}{N_1} y_2^i}{s^e(1-\lambda_1^n)} \tag{6}$$

The last group is the local Muslims who could not get anything out of A. Their period 2 assets are equal to their period 1 assets, i.e., $y_2^{pl} = y_1^m$. The share of these poor locals in period 2 population is given by

$$\lambda_2^{pl} = 1 - \lambda_2^i - \lambda_2^{rl} = \frac{(1-s^e)}{1 + \frac{n_2^i/N_1}{(1-\lambda_1^n)}} \tag{7}$$

We assume that each group is populated by a continuum of agents. We also assume that the transfer to immigrants is strictly below the assets owned by poor local Muslims, i.e., $y_2^i < y_2^{pl} = y_1^m$. Hence, the groups are ranked by their per capita asset holdings as $y_2^i < y_2^{pl} < y_2^{rl}$. Since agents in each group are homogenous with respect to their asset holdings, ranking of individuals within each group is irrelevant. Denote the average asset holding per capita in the region by

$$\bar{y}_1(\lambda_1^n) \equiv \lambda_1^n y_1^n + (1-\lambda_1^n) y_1^m. \tag{8}$$

Consistent with our historical setting, we assume that minorities were on average wealthier than Muslims, i.e., $y_1^n > y_1^m$. Hence, average asset holdings per capita in the region is an increasing function of the share of the minorities λ_1^n in period 1.

Then, with a bit of algebra one can show that in period 2, the share of the poorest λ fraction of the population owns $L_2(\lambda)$ fraction of total assets where

$$L_2(\lambda) = \begin{cases} L_2^i(\lambda) \equiv \phi(\lambda_1^n)\frac{y_2^i}{\bar{y}_1(\lambda_1^n)}\lambda & \text{if } \lambda \in [0, \lambda_2^i] \\ L_2^{pl}(\lambda) \equiv L_2^i(\lambda_2^i) + \phi(\lambda_1^n)\frac{y_1^m}{\bar{y}_1(\lambda_1^n)}(\lambda - \lambda_2^i) & \text{if } \lambda \in (\lambda_2^i, \lambda_2^i + \lambda_2^{pl}] \\ L_2^{rl}(\lambda) \equiv L_2^{pl}(\lambda_2^i + \lambda_2^{pl}) + \phi(\lambda_1^n)\frac{y_2^{rl}}{\bar{y}_1(\lambda_1^n)}\left[\lambda + \frac{s^e(1-\lambda_1^n)}{\phi(\lambda_1^n)} - 1\right] & \text{if } \lambda \in (\lambda_2^i + \lambda_2^{pl}, 1] \end{cases} \tag{9}$$

where

$$\phi(\lambda_1^n) = 1 - \lambda_1^n + \frac{n_2^i}{N_1} \tag{10}$$

$L_2(\lambda)$ is the Lorenz curve for asset holdings and it is defined through three linear functions (L_2^i, L_2^{pl} and L_2^{rl}) defined over three consecutive regions that correspond to the members of the three groups ranked by their assets. Using the Lorenz curve, we can derive the resulting Gini index as

$$G = (\lambda_2^i + \lambda_2^{pl})(1 - L_2^i(\lambda_2^i)) - (1 - \lambda_2^i)L_2^{pl}(\lambda_2^i + \lambda_2^{pl}) \tag{11}$$

It is straightforward to show that

$$\frac{\partial \lambda_2^i}{\partial \lambda_1^n} > 0 \tag{12}$$

$$\lambda_2^i + \lambda_2^{pl} = \frac{n_2^i/N_1 + (1 - s^e)(1 - \lambda_1^n)}{n_2^i/N_1 + (1 - \lambda_1^n)} \tag{13}$$

$$\text{sign}\left(\frac{\partial(\lambda_2^i + \lambda_2^{pl})}{\partial \lambda_1^n}\right) = \text{sign}\left(\frac{s^e n_2^i}{N_1}\right) > 0 \tag{14}$$

$$L_2^i(\lambda_2^i) = \frac{(n_2^i/N_1)y_2^i}{\bar{y}_1(\lambda_1^n)} \tag{15}$$

$$\text{sign}\left(\frac{\partial L_2^i(\lambda_2^i)}{\partial \lambda_1^n}\right) = -\,\text{sign}\left(\frac{\partial \bar{y}_1}{\partial \lambda_1^n}\right) < 0. \tag{16}$$

Since

$$L_2^{pl}(\lambda_2^i + \lambda_2^{pl}) = \frac{(n_2^i/N_1)y_2^i + (1 - s^e)(1 - \lambda_1^n)y_1^m}{\bar{y}_1(\lambda_1^n)}, \tag{17}$$

we also have

$$\frac{\partial L_2^{pl}(\lambda_2^i + \lambda_2^{pl})}{\partial \lambda_1^n} < 0. \tag{18}$$

Combining all the intermediate results with the expression for the Gini index, we can conclude unambiguously that asset inequality increases with the share of minorities:

$$\frac{\partial G}{\partial \lambda_1^n} > 0. \tag{19}$$

If the confiscated assets go to a very small fraction of the local Muslims, i.e., as $s^e \to 0$, the above conclusion still remains intact. If the minority assets were almost equally divided among the entire local Muslims, i.e., $s^e \to 1$, we still have that the Gini index is strictly increasing in the share of minorities as long as there is at least some immigrants coming in after the minorities left and getting some positive transfer out of the confiscated assets.

Furthermore, the asset inequality is decreasing in the fraction of influential local Muslims who manage to receive some share from the confiscated properties, since

$$\frac{\partial G}{\partial s^e} = \frac{(1-\lambda_1^n)\left[\frac{n_2^i}{N_1} y_2^i - y_1^n\right]}{\left(1-\lambda_1^n+\frac{n_2^i}{N_1}\right)\bar{y}_1(\lambda_1^n)} < 0 \tag{20}$$

where the inequality follows because the term in the squared brackets is negative due to the fact that total amount of transfers to immigrants cannot exceed the total amount of assets left behind by the minorities.

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