Minorities and Long-run Development:
Persistence of Armenian and Greek Influence in Turkey [*]

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Abstract

Mass deportations and killings of Ottoman Armenians during WWI and the Greek-Turkish population exchange after the Greco-Turkish War of 1919-1922 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 Christian communities of the region. These communities played a dominant role in craftsmanship, manufacturing, commerce and trade in the Empire. In this paper, we empirically investigate the long-run contribution of the Armenian and Greek communities in the Ottoman period on regional development in modern Turkey. We show that districts with greater presence of Greek and Armenian minorities at the end of the 19th century are systematically more densely populated, more urbanized and exhibit greater economic activity today. These results are qualitatively robust to accounting for an extensive set of geographical and historical factors that might have influenced long-run development on the one hand and minority settlement patterns on the other. We explore two potential channels of persistence. First, we provide evidence that Greeks and Armenians might have contributed to long-run economic development through their legacy on human capital accumulation at the local level. This finding possibly reflects the role of inter-group spillovers of cultural values, technology and know-how as well as the self-selection of skilled labor into modern economic sectors established by Armenian and Greek entrepreneurs. Second, we show some evidence supporting the hypothesis that minority assets were also instrumental in the development of a modern national economy in Turkey.

Keywords: Persistence; Economic Development; 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. Our results are robust to the inclusion of various potential drivers of historical development.

Previous work 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). We offer some evidence suggesting that the legacy of Armenians and Greeks on economic development might have operated both through their indirect contribution on human capital accumulation among Muslims and the transfer of productive assets to the Muslim population in the aftermath of the expulsions.

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 few 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.

That the expulsions removed two biggest minority groups in the Ottoman population enables us not only to exploit substantial regional variation in minority presence, but it also allows us to offer a comparison across the two ethnic groups with respect to their long-run legacies on development. Moreover, the long history of statehood in Anatolia before the arrival of Turkic tribes and other Muslim populations and the long co-existence of Armenians and Greeks with Muslims (for

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

about 8 centuries) that was terminated by large scale expulsions provides an ideal historical setting for our analysis. After all, any indirect impact of economically more advanced ethnic groups on contemporary regional development, would presumably be more pronounced the more established these groups are in their homelands and the longer is the duration of their interactions with other groups. Furthermore, by conducting a sub-national analysis over a territory ruled by the Ottoman Empire for more than 6 centuries until the expulsions and then by the Turkish Republic from 1923 onwards, we are able to largely avoid the influence of institutional heterogeneity that would plague identification in a cross-national analysis.

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 (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

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[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.

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.

First and foremost, this paper contributes to the literature on the expulsion of minorities. For instance, Waldinger's recent work investigates the effect of the expulsion of Jewish academics on German universities focusing on inter-ethnic spillovers (Waldinger, 2012). Relatedly, 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 of minorities from the Ottoman Empire 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. Additionally, Grosfeld et al. (2013) focus on the Pale of Settlement area where Jews were allowed to live in the Russian Empire, and show that current residents of the Pale of Settlement exhibit higher anti-market attitudes, lower entrepreneurship and higher trust. In a similar spirit, we investigate what kind of legacy the historical minority presence left for the predominantly Muslim population that remained.

Furthermore, this study adds to the literature on the socioeconomic and political legacy of minorities. For example, Grosjean (2011) shows that, in parts of South Eastern Europe occupied by the Ottoman Empire, localities with more historical Armenian, Greek or Jewish minorities have higher levels of bank penetration today. Kuran (2004) also points out the overwhelming role of minorities in trade and commerce in the Ottoman Empire. The literature on minorities largely emphasized the role of human capital in development (Glaeser et al., 2004), and, in particular, the role of the human capital possessed by ethno-religious minorities with occupational specialization, higher education and knowhow (Botticini and Eckstein, 2007). In this strand, Becker and Woessmann (2009) provide evidence that Prussian counties with a higher concentration of Protestants were more prosperous in the late 19th century, and they show this effect to be driven by Luther's promotion of education. Hornung (2014) studies the long-term effects of skilled-worker

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immigration on productivity focusing on 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.

This paper also 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 of the outbreak of the Black Death in Europe in the 1340s (Postan, 1973; North and 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).

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 discuss our empirical findings. In Section 5 we offer some suggestive evidence on potential channels, and Section 6 concludes the paper.

2 Historical Background

2.1 The Role of Minorities in the Ottoman Economy

Since its foundation circa 1299 until its dissolution in 1922, the Ottoman Empire stretched across Asia Minor, the Balkans, Maghreb and 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 has emerged a need to institutionalize various groups into the empire in order to maintain peace and order.

After the conquest of Constantinople, which has historically been the center of the Orthodox Christian world, Sultan Mehmet II laid the foundations of the millet system (religious community

or nation in Turkish). The millet system played a key role for the stability of the Ottoman order by governing the internal affairs of a multi-religious and poly-ethnic imperial setting. Under this system, non-Muslim subjects of the Ottoman Empire enjoyed a certain degree of autonomy and were allowed to rule themselves in their religious, educational, juridical and fiscal affairs. Each minority group was organized into a separate millet and was free to elect its own religious leader. For example, Armenian and Greek-Orthodox millets were separate communities presided by their own Patriarchs. Shariah (the Islamic law) had no jurisdiction over non-Muslim minorities and any case among non-Muslims was tried according to their own law. For example, on issues of business conduct, non-Muslims could choose which court to go to. This gave the minorities a further advantage as modern capitalism emerged in Western Europe. They could conduct business under more developed Western legal infrastructure as well as gain tax concessions (Kuran, 2004). In addition to having legal autonomy, minorities were free to use their own language, control their own schools and churches, and collect taxes (Shaw, 1977; Sugar, 1977). They could also opt out of the military by paying poll taxes, which allowed them non-intermittent labor force participation and greater focus on 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).[4][5] 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).[6] 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 regional 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

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[4] As to why minorities had greater economic success, various explanations have been suggested by historians. For example, one reason is that Muslims eschewed finance and commerce, and avoided interest. Alternatively, Westerners favored the Christian subjects of the Ottoman Empire, and in turn, these business networks with the Westerners proved increasingly lucrative as modern capitalism gained pace. Kuran (2004), on the other hand, argues that legal pluralism within the Ottoman Empire allowed minorities to choose more modern Western legal institutions. Thus, minorities thrived economically by adopting Western business practices, forming economic alliances and settling disputes in Western courts, whereas Muslims could not benefit from such modern institutions. See also Kuran and Lustig (2012) on the Islamic legal tradition and its implications for minorities.

[5] The relationship between the Ottoman rulers and the Armenian and Greek minorities was symbiotic to some extent. The Ottoman state depended on the economic success of the minorities for its finances, and in turn, it granted them more liberties.

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

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). A survivor's report after the WW I suggests that even in Erzurum, which today is a poor eastern province in Anatolia, Armenians were dominant in the economic realm. According to the report, 80 percent of local commerce in the vilayet of Erzurum was due to Armenians. They owned about 60 commercial firms with an annual turnover of more than 30,000 Turkish pounds, 500 firms with a turnover between 10,000 and 15,000 Turkish pounds and 2,500 firms with a turnover between 800 and 1,000 Turkish pounds. They controlled most of the trade with other provinces and almost all foreign trade of the vilayet (Kévorkian, 2011).

In addition to the anecdotal historical evidence provided above, Figure 1 provides descriptive evidence on the important role of minorities in the Ottoman economic structure as of 1894/1895. We generate 1894/1895 minority shares at the Ottoman province level as the sum of Greek and Armenian minority shares.[7] This allows us to compute median minority share across provinces. In addition, we have information on income per capita and employment shares in commerce and industry at the Ottoman province level in 1894/1895. We observe in the left-panel of Figure 1 that, in 1894/1895, average income per capita of Ottoman provinces with above median minority share was larger than that of those provinces with below median minority share, 123.6 *kurus* versus 111.5 *kurus*. Moreover, the right-panel of Figure 1 shows that average employment share in commerce and industry in provinces with above median minority presence was 33.7%, while it was 30.3% in provinces with below median minority share.

Figure 2, on the other hand, provides us with the evolution of the population density across provinces with above and below median minority shares between 1893-1906. The upper-panel of Figure 2 shows that the population density of provinces with above median minority share was higher in 1893 than those with below median minority share. Importantly, this gap in population density grew even larger by 1906. In 1893, average density across high minority provinces was about 23.9 persons per square km, while it was 12.8 in low minority provinces, with a difference of about 11. By 1906 however, average density across high minority provinces was up to 28.8 persons per square km, while that of low minority provinces rose to 14.8, with a difference of about 14. The increase from 1893 to 1906 in the population density gap between high minority and low minority provinces is telling. High minority provinces not only had larger population density at the end of the 19th century, but they also had a higher growth pattern compared to those provinces with low minority presence. The lower panel of Figure 2 provides further supporting evidence on the positive association between population density and minority share from a regression of log population density on minority shares at the province level between 1893-1906. Positive slope coefficient is about 2.3 with a t-stat of 6.3. Thus, between 1893-1906, there was a positive and significant relationship between population density and minority shares.

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[7]We have province-level information for 27 provinces (Karpat, 1985).

Averages across Ottoman Provinces with Above and Below Median Minority Share, 1894/1895

Mean Income per capita (in *kurus*)

Mean Employment Share in Commerce and Industry

Minority Share:
Above Median
Below Median
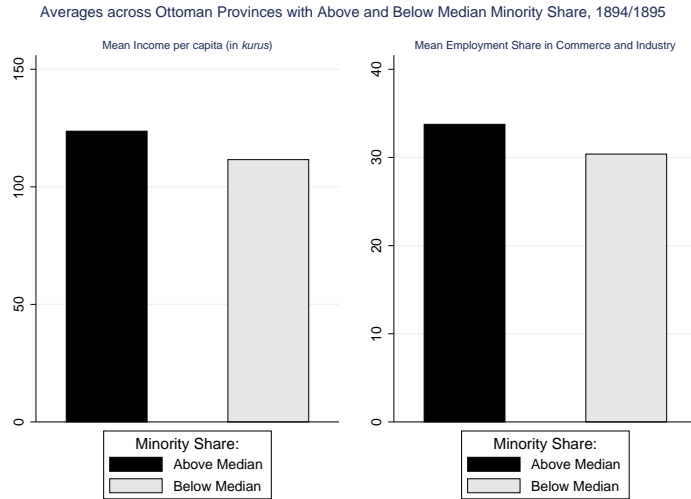
FIGURE 1: Minority Presence and Economic Structure in late 19th century Ottoman Provinces

Mean Population Density across Provinces with Above and Below Median Minority Shares

Log Population Density

Minority Share:
Above Median   Below Median

Log Population Density and Minority Share, 1893-1906
(Unconditional Relationship)

Log Population Density

Minority Share

Fitted values   Log Population Density

Slope coefficient = 2.31; (robust) standard error = 0.36; t-statistic = 6.34; observations = 220

FIGURE 2: Minority Presence and Population Density in Ottoman Provinces

2.2 Expulsion of Minorities from their Homelands

The Young Turk Committee of Union and Progress (CUP), mostly Muslim students, staged a coup and seized power from Sultan Abdulhamid II 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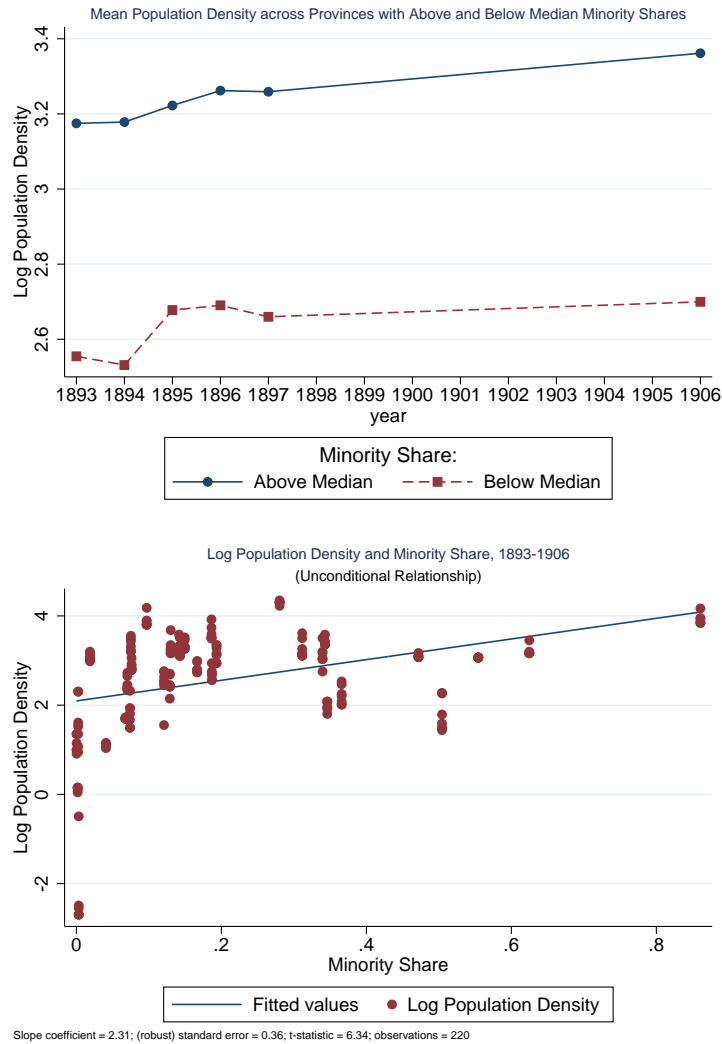 leaders and intellectuals were arrested. Then, Armenian populations of Anatolia and European Turkey were removed through massacres and death marches to the camps in Syrian desert. By the end of First World War, virtually all of around 1.5 million Armenians were removed from Asia Minor, most of them were 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 en masse. 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 the First World War and in its aftermath, de-Christianization 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 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.[8] 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.[9]

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).[10] This census is the first Ottoman Census where not only male, but also female population of the Empire was counted.[11] Unlike the Muslim groups, who are

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[8]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.

[9]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.

[10]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.

[11]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

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, where the census counts were known to be incomplete mostly due to the practical difficulty of counting various nomadic tribes.[12] 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.[13] 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 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.[14] In most of the cases, an Ottoman kaza is

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.

[12]The regions that both overlap with modern Turkish boundaries and were subject to incomplete count are Erzurum Province, Bitlis Province, Dersim (Hozat) in Elaziz Province and Hakkari Sancak in Van Province.

[13]Instead of dropping these districts from the sample, we have also repeated our empirical analysis using alternative measures for Ottoman population that take into account the sancak/vilayet level estimates for uncounted populations reported in the Census. These measures are constructed assuming that (i) all uncounted populations consisted of Muslims —the most reasonable assumption given that no information is available about the religious breakdown of the uncounted population— and (ii) each kaza in a sancak/vilayet with incomplete census was inhabited by a fraction of the uncounted population in that sancak/vilayet that is equal to the fraction of the counted sancak/vilayet population who lived in that kaza. Our results were qualitatively robust to employing these alternative population measures on a larger sample.

[14]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

either matched with a single or often times to multiple modern districts, as the former is usually geographically larger than the latter.[15] Our unit of observation is a modern district.

Figure 3 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.
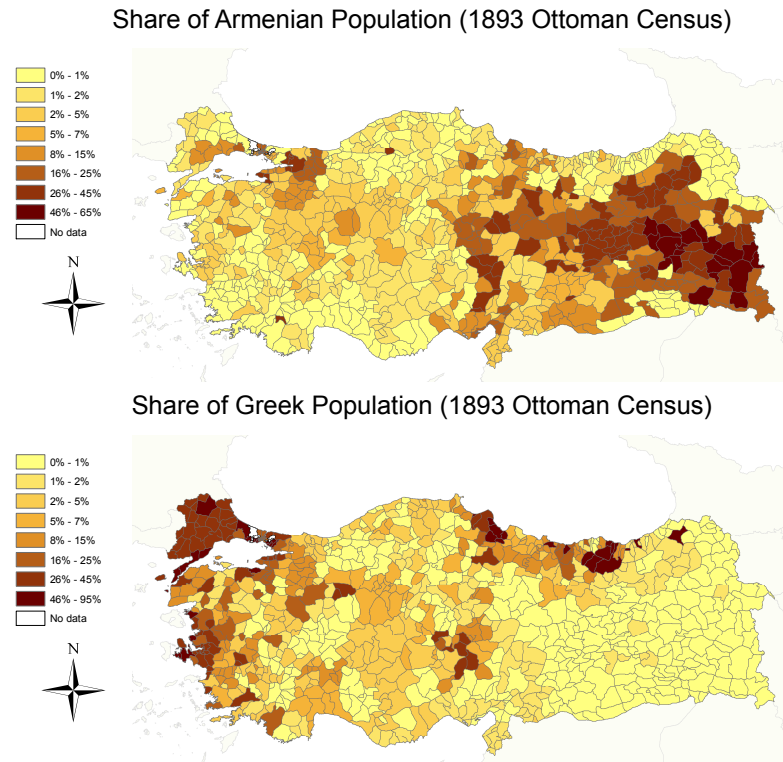
FIGURE 3: Minority Shares in the late 19th century Ottoman Empire

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

hierarchy it used to belong. A couple of cases for which no reliable information can be obtained is left out of the sample.

[15]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.

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 density and urbanization rates at the district level obtained 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 Turkey make the former highly influential in our empirical analysis.[16] 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.[17] The luminosity data is obtained from the Defense Meteorological Satellite Program's (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.[18] We construct a measure of average

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[16]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.

[17]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.

[18]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

light density in 2000 at the district level, averaging across pixels that fall within district boundaries. Two maps in Figure 4 depict the resulting cross-district distribution of average luminosity along with the historical representation of Armenians and Greeks in the Ottoman population.

Armenian Share (1893 Ottoman Census)

0% - 0.255% 0.264% - 0.794% 0.833% - 1.403% 1.56% - 2.782% 2.834% - 5.041% 6.005% - 9.652% 10.233% - 15.397% 15.881% - 23.276% 24.08% - 34.86% 39.802% - 64.621%

Greek Share (1893 Ottoman Census)

0% - 0.378% 0.431% - 1.162% 1.233% - 2.332% 2.487% - 3.72% 4.07% - 6.036% 6.248% - 9.991% 10.245% - 14.739% 15.603% - 22.833% 24.285% - 40.679% 42.818% - 92.877%
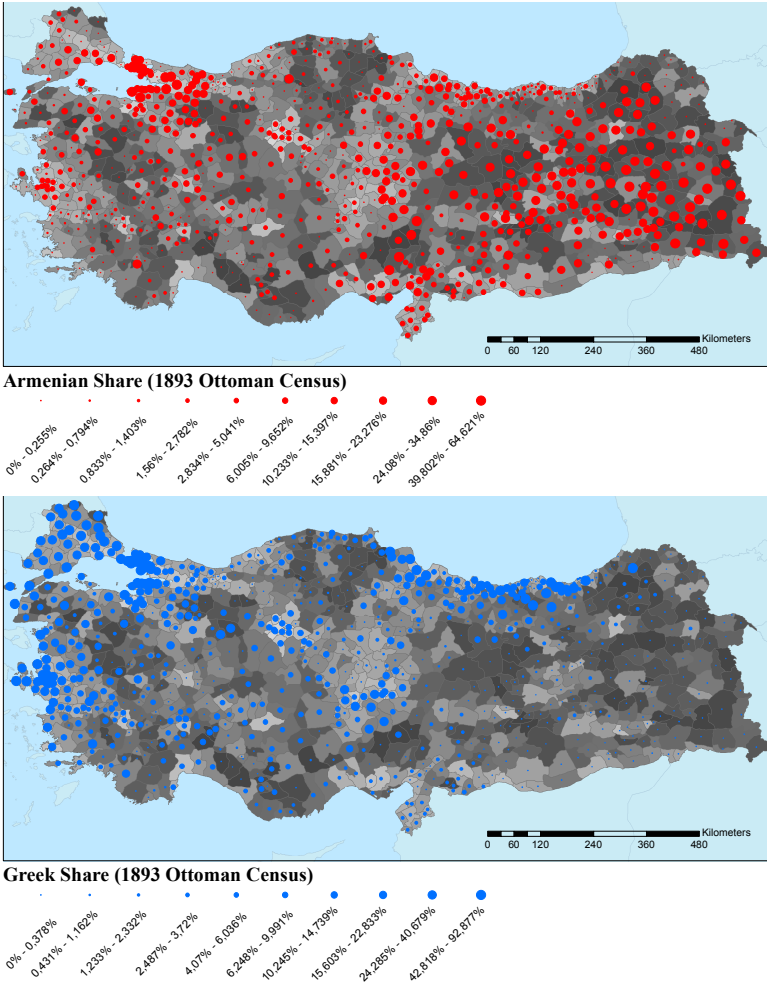
FIGURE 4: Minority presence (1893) and average luminosity (2000) across Turkish districts

Darker areas show districts with lower economic activity as proxied by average luminosity. It is worthwhile to note that these maps simply describe unconditional patterns in the data. Thus, given the potential role geographical and historical factors might have played in shaping the level of economic activity as well as historical minority shares, these maps do not allow us to make a meaningful inference about the potential legacy of Greeks and Armenians on the distribution of contemporary economic activity.

Finally, we make an internal assessment of the luminosity measure. Figure 5 shows the strong positive correlation at the province level between GDP per capita and average luminosity in

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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.

2000, offering direct evidence that light density is a good proxy for local economic activity in the Turkish context. The R-squared of this bivariate relationship is around 33 percent.
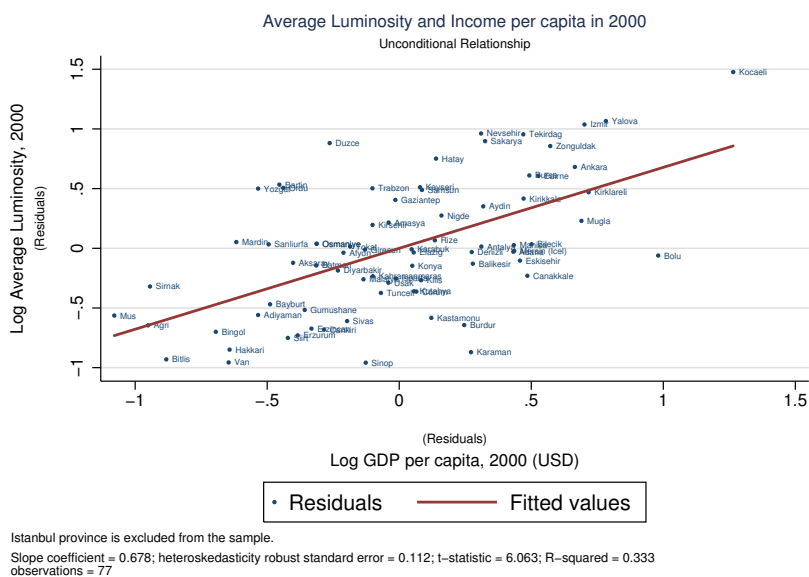
FIGURE 5: The relationship between province income and luminosity

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 elevation), average annual temperature and precipitation as well as a measure of agricultural suitability. In all regressions we also control for a proxy of population density in 1893 in the Ottoman kaza or sancak. Given that information about boundaries and areas of Ottoman kazas/sancaks in 1893 is not available, we approximate population density of an Ottoman location by using the sum of the areas of modern districts to which this Ottoman location has been assigned.

Table 1 shows the summary statistics for all the variables we use in our empirical analysis including those that will be discussed when we show robustness of our results. When we present our estimation results, the marginal effects that we will report at the bottom of the regression tables will be based on a hypothetical move from 10th to the 90th percentile of the regional distribution of Greek and Armenian presence. According to the descriptive statistics in Table 1 this move roughly corresponds to increasing Armenian and Greek shares from 0 to 20 percent and 0 to 26 percent, respectively. In regressions where the variable of interest is the minority population size, instead of

TABLE 1: Summary Statistics

						Percentile	
Variable	Obs	Mean	Std. Dev.	Min	Max	10th	90th
Population density, 2000	765	4.09	1.06	1.37	9.34	2.95	5.36
Urbanization rate, 2000	765	0.46	0.20	0.09	1.00	0.22	0.75
Average luminosity, 2000	765	0.77	1.05	-3.43	4.00	-0.53	1.98
Log population, 1893	765	10.76	0.75	8.25	12.38	9.82	11.74
Proxy for log population density, 1893	765	2.56	1.00	-0.37	6.02	1.39	3.69
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
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
Mean annual temperature	765	0.01	0.00	0.01	0.02	0.01	0.02
Mean annual precipitation	765	0.64	0.20	0.33	1.73	0.44	0.88
Suitability to cultivation	765	4.18	1.65	0.24	9.34	2.04	6.44
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 in province	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
Log distance to Istanbul	765	6.04	0.67	3.52	7.19	5.11	6.84
Log distance to nearest national border	765	5.18	0.88	1.66	6.27	3.97	6.07

minority share, the move from 10th to the 90th percentile is equivalent to increasing the number of Armenians from 0 to roughly 10,700 and the number of Greeks from 0 to roughly 21,300.

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 measures of minority presence. Following the common practice, our main measure is the population share of Armenians and Greeks in the population. The second measure is their population size. 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 sizable 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. In our main regressions, we estimate the following equation using OLS:

$$y_i = \beta + \alpha \left(armshr_{1893}\right)_{k_i} + \gamma \left(greshr_{1893}\right)_{k_i} + \delta \ln \left(popden_{1893}\right)_{k_i} + \theta' \mathbf{X_i} + \varepsilon_i. \tag{1}$$

y_i denotes the modern outcome of interest (population density, urbanization or light density in 2000) for a modern district i. The independent variables of interest are the historical Armenian and Greek population shares ($armshr_{1893}$ $greshr_{1893}$) in the Ottoman kaza (or sancak) k_i to which district i was assigned.[19] Our primary goal is to assess whether minority presence made a difference above and beyond its potential influence on historical levels of development prior to expulsions. Thus, natural logarithm of population density $popden_{1893}$ in k_i is included in the model as a proxy for initial economic conditions. Conditioning on historical population density is essential to make a meaningful comparison between post-expulsion changes in our outcome measures across districts with different historical minority presence. It also allows us to partly account for the bias due to historical selection. While part of historical population density presumably reflects the contribution of Armenians and Greeks on local development, it is also possible that some other determinants of population density in 1893 might at the same time have led to selective migration.

Since in several instances, multiple districts are assigned to a given Ottoman administrative unit, the 1893 figures for the minority populations capture the exposure of district i to historical Armenian and Greek 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 coefficients of interest α and γ reflect the kaza/sancak level fixed effect of Armenian and Greek minorities on modern district

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[19]Our baseline model includes both the Armenian and Greek populations simultaneously to account for any bias that would result if the two biggest Christian populations of the Empire showed a tendency to sort into localities where the other group was more or less concentrated. One potential reason for positive sorting could be the complementarities between Armenian and Greek presence in particular economic activities that require different sets of skills and expertise possessed by the two groups. Another reason could be economies of scale in the provision of religious public goods at the local level. One reason for negative sorting could be the desire to escape from competition in those economic sectors where Greek and Armenian human capital were substitutes rather than complements. Our results remain qualitatively unaltered when we include Armenian and Greek populations separately.

outcomes. Finally, $\mathbf{X_i}$ denotes the vector of geographical attributes we include in our baseline estimating equation.

In the appendix, we also show estimation results from an alternative specification to assess whether the *absolute size* of minority groups, i.e., natural logarithm of Armenian and Greek population in 1893, has a qualitatively different relationship with contemporary outcomes than minority *shares*. Also, in this alternative model, as different from equation (1), we control for total historical population size instead of population density to prevent the minority size variables from picking up a potential scale effect that otherwise would be attributed to overall population size of the Ottoman location.

4   Empirical Results

4.1   Minorities and Historical Population Density

In order to put our contemporary results in perspective, we need to document how regional population dynamics were related to Armenian and Greek presence prior to and in the aftermath of the expulsions. In particular, we need to establish (i) whether there was a meaningful gap in population density back in 1893 between Ottoman districts with high and low minority concentration and (ii) to what extent the expulsions affected population density in the short-term in districts with considerable Greek and Armenian presence.

If we are to interpret a positive correlation between historical minority presence and contemporary measures of development as evidence of a positive legacy of minorities, then we should also observe a positive association between minority presence and the level of development back in 1893. In the historical background section, we have shown that in those provinces with above-median minority share, average income per capita in 1894/95 was higher than in provinces below the median. Despite that historical income data is not available for Ottoman districts to verify a similar relationship more systematically and at a more disaggregated level, to the extent the Ottoman economy was still governed by Malthusian dynamics back in 1893, population density should serve as a good proxy for the level of development.

Figure 6 presents the conditional and unconditional relationships between minority shares and population density in 1893. On the upper left hand side is the residual scatter plot that describes the correlation between Armenian share and population density conditional on Greek share. This otherwise unconditional relationship simply reflects the fact that historically the areas where Armenians settled were on average less densely populated. As the figure right below it demonstrates, this negative relationship disappears, i.e., becomes statistically indistinguishable from zero, once conditioned on our geographical controls. This should not come as a surprise when we consider that historical homeland of Ottoman Armenians was situated in the eastern half of Turkey in which there was a significant Armenian concentration in the mountainous interior regions with less than ideal climate and soil conditions for agriculture to allow for dense settlements. It is also worth noting the potential influence of the west-east gradient that historically characterized

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development potential in Anatolia. Being far from the main economic centers in the West and fairly isolated from the central authority, the areas with high Armenian presence were systematically disadvantaged both in terms of exposure to economic spillovers and security. Nonetheless, as the bottom left hand side figure suggests, once we account for the fixed effects at the level of Ottoman provinces (vilayet), we see a strong positive relationship between Armenian share and population density. The three corresponding figures on the right hand side paint a qualitatively different picture for Greeks. Taken together they imply that unlike Armenians, Greeks were concentrated in areas that were geographically more conducive to high density settlements with greater economic potential, which looking at their settlement patterns depicted in Figure 3 should not come as a surprise. Once we control for geographical attributes the relationship becomes weaker in magnitude but remains highly significant. However, that in the presence of province fixed effects, the positive relationship disappears might be an indication that the previous relationship was mostly driven by positive selection of Greeks in inherently more advantaged regions.

To explore the short-term impact of expulsions on regional population density, next we regress population density in 1927 on historical minority presence at the district level. Since we want to isolate the impact of expulsions as much as possible, we need to compare districts that had similar levels of population density before the expulsions. Hence, we control for population density in 1893 in all regressions. Figure 7 describes a subset of our results.

The striking negative correlations for both Armenians and Greeks are consistent with the mechanical impact of deportations and the population exchange in reducing population density. Among areas with similar levels of population density before the Armenian deportation, those that were inhabited by a higher share of Armenians were significantly less populated 10 years after the expulsions and mass killings. A similar conclusion holds for the impact of Greek expulsions, and both relationships are robust to conditioning on geographical attributes as well as fixed effects at the region or sub-region level.

As we argue in subsequent sections, in the longer-run, the recovery process not only eliminated the post-expulsion density gap between low- and high-minority areas, but it eventually led to the (re)emergence of significant differences in population density in favor of the latter. Moreover, we show that these differences mirror differences in urbanization and economic activity. Taken together, these findings are consistent with our persistence hypothesis and presumably reflect what we call the positive legacy of Armenian and Greeks. If we accept the idea of a positive minority legacy, the following figures offer a basic illustration, consistent with the historical evidence provided in Figures 6 and 7, of how population densities might have evolved over time in regions with and without Armenian/Greek presence.

The left hand side panel of Figure 8 compares the evolutions of population density in two hypothetical areas –shown with light green and dark red curves– with a significant Armenian presence to another hypothetical area, possibly in the same province but exclusively inhabited by Muslims –shown with a black curve. What distinguishes the first Armenian region Arm_1 from the second Armenian region Arm_2 is that in 1893 the former had the same level of population density

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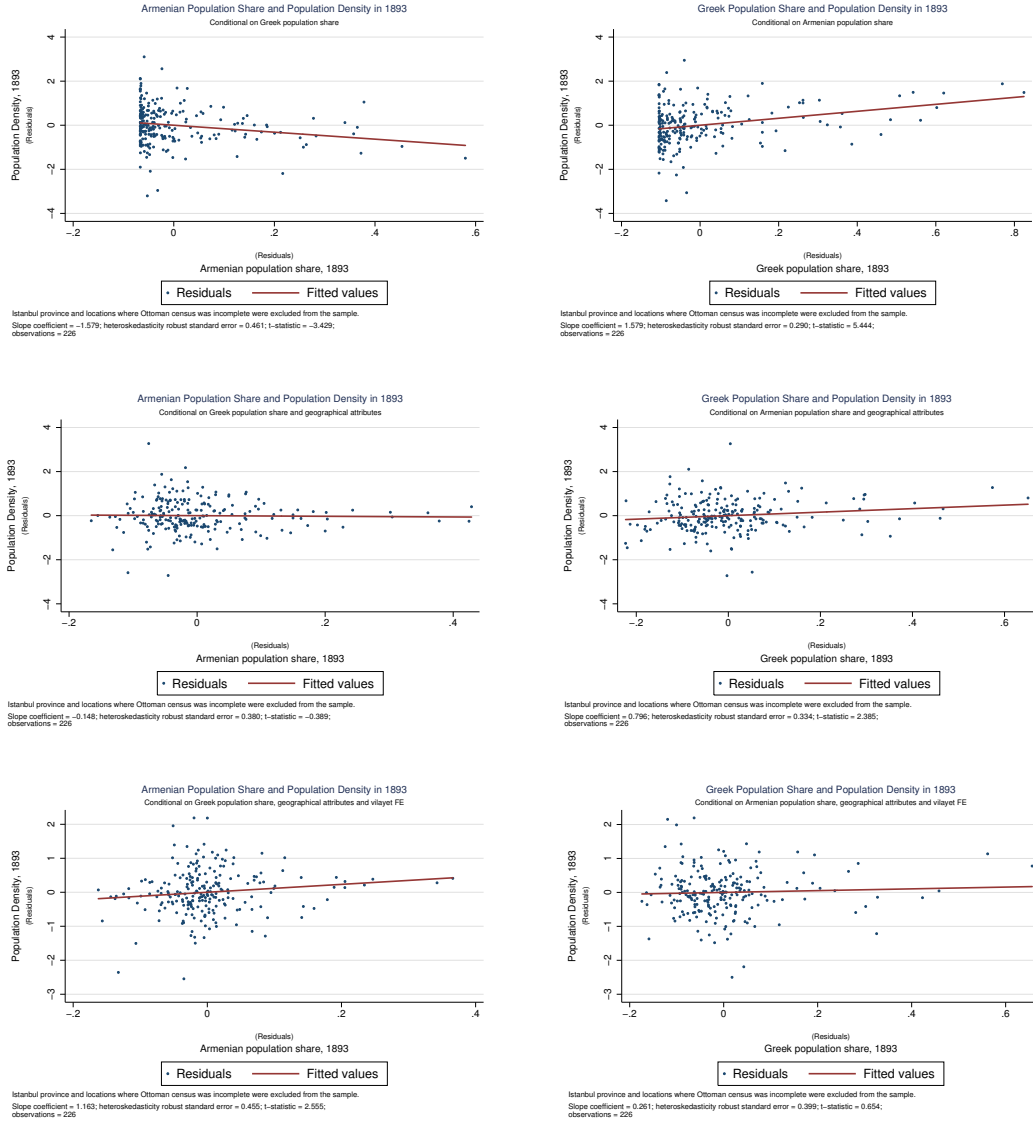
Figure 6: Pre-expulsion conditions: Minority shares and population density in 1893

as the Muslim region (*Mus*) while the latter represents the average Armenian region which was more densely populated than the Muslim region already in 1893. As shown in the figure, over the period 1914 to 1918 both Armenian regions must have experienced a sharp decline in density due to the mass killings and deportations, and consistent with the results in Figure 7 the post-expulsion recovery was not fast enough for Arm_1 to catch-up with *Mus*.[20] If, despite the loss of human capital due to deportations, Armenian and Muslim co-presence indeed left a positive legacy for future development potential in Arm_1 and Arm_2, then both Armenian regions would converge

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[20]Over the period 1914-1918 many Ottoman regions experienced declines in population due to WW1, which clearly would reduce population density in all regions including *Mus*. For a simpler exposition, in Figure 8 we do not show this impact of war. Thus, both of our illustrations, by singling out the impact of expulsions, can be thought as representing the effect of deportations and population exchange net of the destructive influence of war.
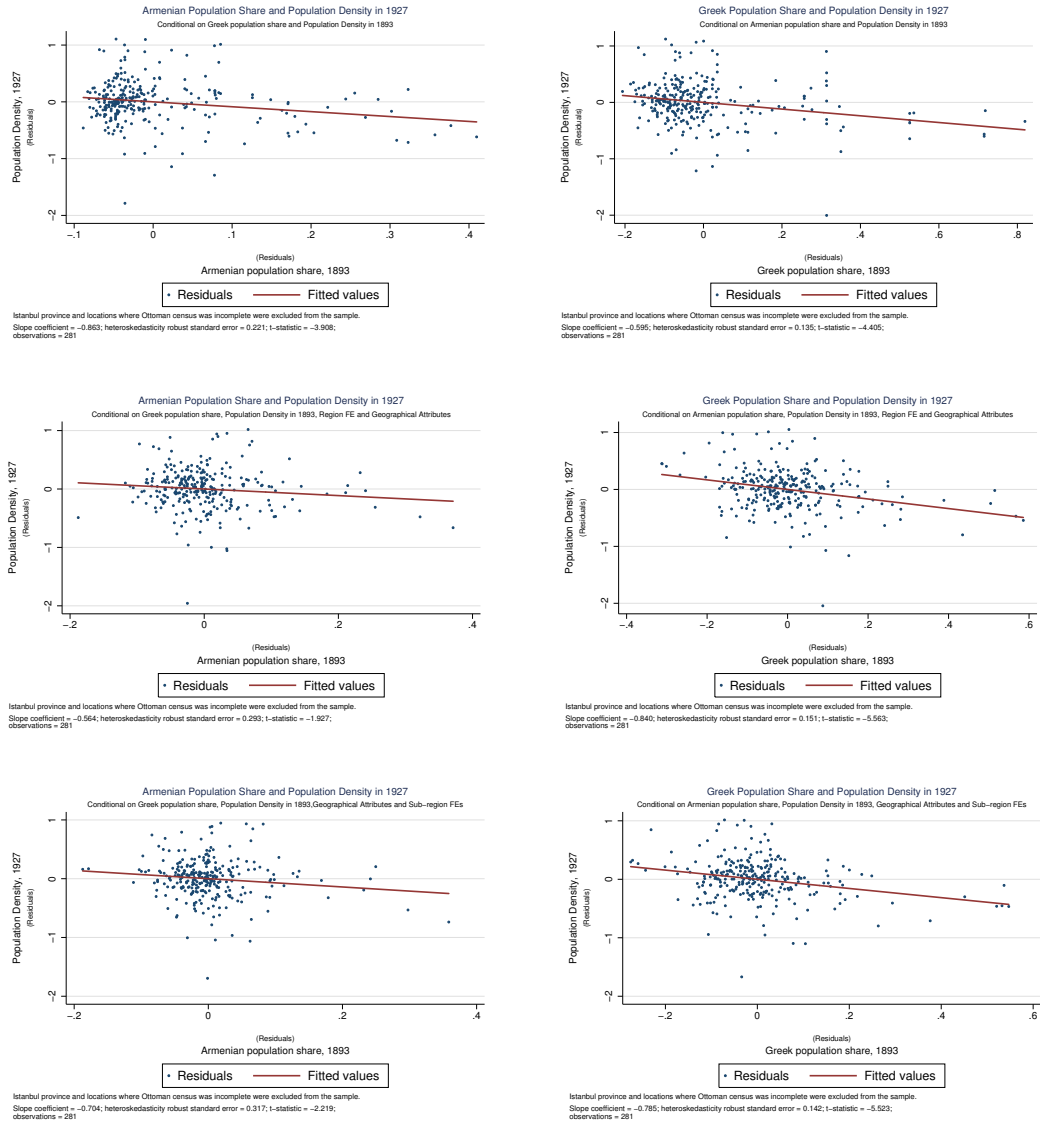
FIGURE 7: Short-term impact of expulsions: Minority shares and population density in 1927

to higher "steady-state" levels of population density than *Mus*, and on the way to their steady states they would grow faster and eventually take over *Mus*. Though not an essential part of our hypothesis, in order to represent the adverse effect of deportations on regional development, we also include the counterfactual trajectories the two Armenian regions would follow, if deportations never took place. The dashed curves depict these counterfactual paths which converge to steady states that lie above the 'actual' steady states. The story for Greeks, as illustrated in the right hand side of Figure 8, would be qualitatively the same except that the negative population shocks associated with the Greco-Turkish War and the eventual population exchange took place in the early twenties.[21]

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[21] Our illustrations abstract from potential differences between Armenians and Greeks in terms of the post-expulsion recovery dynamics. Both the differences in historical settlement regions and the distinct nature of the two shocks
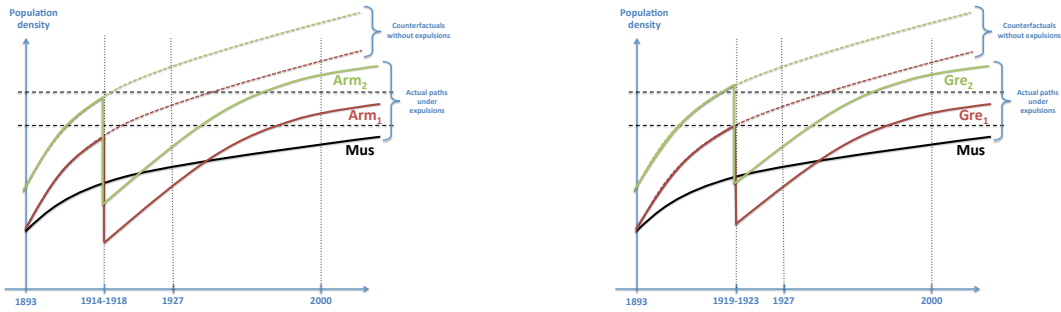
FIGURE 8: The evolution of population density in predominantly Armenian, Greek and Muslim regions

Analyzing contemporary population densities, the next section offers the first piece of evidence that is consistent with the persistence hypothesis we have just outlined.

4.2 Minorities and Contemporary Population Density

If Armenian and Greek minorities contributed to regional development in a persistent way, one would expect, as illustrated in Figure 8, contemporary population density to be systematically higher in areas with greater Armenian and Greek presence, even after controlling for pre-expulsion densities. To verify if this conjecture is supported by data, we first use population density of a district in 2000 as our outcome measure. 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 contemporary development, population density is a good starting point at least in our attempt to understand the potential legacy of minorities on current demographic patterns.

Table 2 presents the results. To highlight the distinction between short-run impact of expulsions from the long-run comparison of the levels of population density across high and low minority districts, in Panel A we first report the full set of results for population density in 1927. Part of these results have already been summarized by the partial correlation plots in Figure 7. Panel B presents the partial correlations of population density in 2000 with Armenian and Greek population shares.[22] In each panel, we start with a specification that only includes historical minority shares and population density in 1893. Then we add a set of dummies for each of the seven geographic regions of Turkey.[23] In the third column, we add latitude and longitude and continue

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–mass deportations versus a population exchange that involved partial replacement of Greek emigrants with Muslims in Greece– arguably influenced the speed, extent and composition of the post-expulsion inflow of immigrants to and fertility rates in these regions differently.

[22]All our results remain qualitatively intact when we include Greek and Armenian shares separately.

[23]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

expanding our model with the remaining set of geographical controls until we reach column 7. 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. Genc Sancak in Bitlis Province).[24] Unless stated otherwise, we report the percentage change in the level of outcome variables in response to increasing our variable of interest from 10th to the 90th percentile of its cross-district distribution in the sample. For Armenians and Greeks these moves are equivalent to raising their shares in total population from 0 to 20 percent and from 0 to 26 percent respectively.

Moving to results in panel A, both Armenian and Greek shares in 1893 appear as negative and statistically significant correlates of district population density in 1927 in all specifications. This is not surprising given that it must have taken quite some time for population levels in these regions to recover after mass expulsions. According to the baseline specification in column (8), population density in 1927 in a district with 20 percent historical Armenian share was almost 11 percent lower than in similar a district without Armenians. Comparing the two minority share coefficients we see that an increase in population shares of both groups by the same amount is associated with a somewhat stronger decline in density for Greeks. Naturally the difference in marginal effects of moving from 10th to the 90th percentile are even bigger given that 90th percentile in the Greek distribution corresponds to a higher population share than it does in the Armenian distribution. In a district at the 90th percentile of the Greek share distribution, population density is predicted to be lower in 1927 by more than 25 percent relative to a district at the 10th percentile of the same distribution.

The results for population density in 2000 are reported in panel B. They are qualitatively opposite of the results for 1927 density regressions. This reversal in the relationship supports our view that despite enduring more pronounced negative shocks to population in the aftermath of the expulsions, over the longer term, regions with relatively greater Armenian and Greek presence nonetheless managed to takeover their ethno-religiously more homogenous counterparts. As reported at the bottom of panel B, the marginal effects of a 10th-to-90th percentile move are comparable for Greeks and Armenians –around 25 percent increase in 2000 population density–, but the marginal effect for Armenians appears larger when we consider an increase in population shares by the same amount.

It is crucial to note that without conditioning on topographical features (elevation and ruggedness), districts with significant Armenian presence are not more densely populated –even after we account for region fixed effects, longitude and latitude (see columns 1-3). The coefficient on Armenian share increases almost twofold and turns highly significant only after elevation and

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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.

[24]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.

TABLE 2: Historical Minority Shares and Population Densities in 1927 and 2000

	Log(Population density in 1927)							
PANEL A	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) OLS	(8) OLS
Armenian population share, 1893	-0.863***	-0.623**	-0.682**	-0.633**	-0.557**	-0.559**	-0.564**	-0.704**
	[0.185]	[0.241]	[0.269]	[0.270]	[0.280]	[0.282]	[0.283]	[0.320]
Greek population share, 1893	-0.595***	-0.667***	-0.660***	-0.764***	-0.818***	-0.823***	-0.840***	-0.785***
	[0.119]	[0.119]	[0.125]	[0.129]	[0.135]	[0.136]	[0.136]	[0.146]
Proxy for population density in 1893	0.794***	0.741***	0.737***	0.702***	0.705***	0.707***	0.706***	0.728***
	[0.032]	[0.044]	[0.045]	[0.046]	[0.045]	[0.046]	[0.047]	[0.052]
Observations	281	281	281	281	281	281	281	281
Adjusted R-squared	0.691	0.698	0.696	0.712	0.712	0.71	0.71	0.717
Effect of increasing Armenian share	-13.284***	-9.589***	-10.495**	-9.753**	-8.581**	-8.599**	-8.690**	-10.837**
from the 10-th to the 90-th percentile	[2.842]	[3.711]	[4.149]	[4.165]	[4.308]	[4.339]	[4.364]	[4.926]
Effect of increasing Greek share	-19.366***	-21.727***	-21.479***	-24.874***	-26.627***	-26.806***	-27.354***	-25.560***
from the 10-th to the 90-th percentile	[3.871]	[3.870]	[4.076]	[4.199]	[4.385]	[4.434]	[4.444]	[4.762]

	Log(Population density in 2000)							
PANEL B	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) OLS	(8) OLS
Armenian population share, 1893	0.083	0.918	0.647	1.247***	1.326***	1.284***	1.270***	1.282***
	[0.479]	[0.563]	[0.623]	[0.468]	[0.439]	[0.462]	[0.451]	[0.448]
Greek population share, 1893	1.799***	1.667***	1.663***	1.039***	0.853**	0.903***	1.097***	1.003**
	[0.512]	[0.500]	[0.500]	[0.359]	[0.337]	[0.341]	[0.359]	[0.401]
Proxy for population density in 1893	0.018	-0.075	-0.074	-0.123	-0.126	-0.131	-0.117	-0.131**
	[0.087]	[0.095]	[0.102]	[0.081]	[0.084]	[0.086]	[0.082]	[0.059]
Observations	765	765	765	765	765	765	765	765
Adjusted R-squared	0.055	0.093	0.094	0.291	0.317	0.317	0.328	0.353
Effect of increasing Armenian Share	1.645	18.210	12.846	24.756***	26.310***	25.475***	25.200***	25.453***
from the 10-th to the 90-th percentile	[9.507]	[11.174]	[12.355]	[9.290]	[8.710]	[9.163]	[8.941]	[8.882]
Effect of increasing Greek Share	46.367***	42.977***	42.869***	26.788***	21.987**	23.291***	28.280***	25.859**
from the 10-th to the 90-th percentile	[13.189]	[12.901]	[12.897]	[9.260]	[8.697]	[8.778]	[9.248]	[10.339]

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Modern region dummies		✓	✓	✓	✓	✓	✓	
Longitude & Latitude			✓	✓	✓	✓	✓	✓
Average Elevation & Ruggedness				✓	✓	✓	✓	✓
Lake, sea and major rivers					✓	✓	✓	✓
Temperature & Precipitation						✓	✓	✓
Suitability to cultivation							✓	✓
Modern subregion dummies								✓

ruggedness are controlled for. Today, perhaps more than in the past, areas of higher altitude and ruggedness are relatively less populated, and our regressions –not shown here– confirm that even within a geographical region Armenians tended to inhabit areas with greater elevation which also happen to be more rugged.[25] These two observations explain why omitting elevation and ruggedness introduces a downward bias in the estimates, hence demonstrating an important instance in which Armenian settlement patterns were characterized by strong *negative* selection. For Greeks, on

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[25]Our findings also suggest that, *conditional on elevation*, Armenians tended to concentrate in less rugged areas. This is consistent with the fact that, being a relatively more sedentary and urbanized community, they settled in less mountainous areas than the Muslims of the same region. Also, a significant part of the Muslim population of the Eastern Provinces consisted of predominantly Kurdish nomadic pastoralists.

the other hand, the point estimates, albeit remaining highly significant all throughout, moves in the opposite direction when we control for topography, possibly reflecting the fact that Greeks historically concentrated in coastal regions with significantly lower altitude and ruggedness. This finding presumably points to a *positive* selection bias for Greeks. However, the fact that the estimated coefficients of interest –both for Greeks and Armenians– remain fairly stable across the remaining columns, where we add the rest of the geographical controls (columns 5-8), is reassuring. These results imply that the geographical attributes –with the exception of topography– do not seem to be a major problem in our context.[26]

Finally, in Appendix Table A.2 we repeat the contemporary analysis in panel B of Table 2 using a larger sample that also includes the regions where the Ottoman census of 1881-1893 was incomplete. For these regions, we employ estimated figures for uncounted populations and make adjustments to reported counts of such Ottoman districts as described in footnote 13. The results remain qualitatively unaffected.

4.3 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 a positive correlation between minority share in the past and urbanization today. Part of the correlation between Greek and Armenian presence and urbanization rates might simply be an artifact of selection of minorities on historical urbanization patterns and the persistence of the latter into contemporary period. This however does not preclude the possibility that regional disparity in historical urbanization rates were partly shaped by 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, but which interpretation plays a more significant role is empirically hard to identify.

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 8 suggest that, keeping other variables constant, a move from 10th to the 90th percentile of the regional distribution of Armenian population

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[26]In panel A of the Appendix Table A.1, we replicate the analysis in panel B of Table 2 using an alternative specification where independent variables of interest are log minority population sizes instead of minority shares. Also, we control for log total population in 1893 instead of our proxy for population density in 1893. The results are qualitatively similar to those in Table 2, except that the coefficient on Greek population size decreases in magnitude and loses its statistical significance at conventional levels when subregion dummies are added.

TABLE 3: Historical Minority Shares and Urbanization Rate in 2000

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) OLS	(8) OLS
	Urbanization rate in 2000							
Armenian population share, 1893	0.156**	0.242***	0.283***	0.333***	0.347***	0.393***	0.391***	0.508***
	[0.075]	[0.082]	[0.097]	[0.081]	[0.078]	[0.070]	[0.069]	[0.086]
Greek population share, 1893	0.248***	0.251***	0.247***	0.194***	0.191***	0.189***	0.217***	0.201***
	[0.071]	[0.073]	[0.069]	[0.060]	[0.058]	[0.057]	[0.060]	[0.069]
Proxy for population density in 1893	-0.029*	-0.028*	-0.028*	-0.032**	-0.032**	-0.032***	-0.030***	-0.028**
	[0.015]	[0.015]	[0.015]	[0.013]	[0.013]	[0.012]	[0.011]	[0.011]
Observations	765	765	765	765	765	765	765	765
Adjusted R-squared	0.040	0.043	0.045	0.083	0.085	0.097	0.103	0.114
Effect of increasing Armenian share	3.091**	4.796***	5.626***	6.605***	6.892***	7.806***	7.766***	10.075***
from the 10-th to the 90-th percentile	[1.482]	[1.626]	[1.917]	[1.616]	[1.543]	[1.392]	[1.378]	[1.697]
Effect of increasing Greek share	6.405***	6.481***	6.376***	5.013***	4.912***	4.873***	5.593***	5.189***
from the 10-th to the 90-th percentile	[1.827]	[1.879]	[1.777]	[1.548]	[1.491]	[1.472]	[1.535]	[1.785]
Modern region dummies		✓	✓	✓	✓	✓	✓	
Longitude & Latitude			✓	✓	✓	✓	✓	✓
Average Elevation & Ruggedness				✓	✓	✓	✓	✓
Lake, sea and major rivers					✓	✓	✓	✓
Temperature & Precipitation						✓	✓	✓
Suitability to cultivation							✓	✓
Modern subregion dummies								✓

shares is associated with an increase in urbanization rate by 10 percentage points, a change that is statistically significant at the 1 percent level. The evidence on Greeks is qualitatively similar, but smaller in magnitude. The positive association between Greek population share and urbanization rate –with an estimated change of around 5.2 percentage points in urbanization rate under the baseline model– is also significant at the 1 percent level.[27]

Like before, in Appendix Table A.3 we rerun the regressions in Table 3 using a larger sample that also includes the regions where the Ottoman census of 1881-1893 was incomplete, and the adjusted minority share and population density figures that account for estimates of uncounted populations. The results are quite similar both in terms statistical significance and estimated magnitudes.

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[27]In panel B of the Appendix Table A.1, we replicate the analysis in Table 3 using an alternative specification where independent variables of interest are log minority population sizes instead of minority shares. Also, we control for log total population in 1893 instead of our proxy for population density in 1893. The results are qualitatively similar to those in Table 3, except that the positive association between urbanization rate and historical Greek population size is somewhat less robust.

4.4 Minorities and Contemporary Economic Development as Measured by Luminosity

4.4.1 Historical Minority Presence 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 once potentially confounding factors are accounted for. While the descriptive maps in Figure 4 did not reveal much about the conditional nature of these relationships, the evidence in Table 4 corroborates our earlier findings about population density and urbanization. Both Armenian and Greek shares are highly significant and positive predictors of economic development. Raising the share of Armenian population from 10th to the 90th percentile of its cross-regional distribution is associated with an increase in average district luminosity by 26 percent at the sample mean (column 8). These estimated magnitudes are economically meaningful. Back of the book calculations based on the unconditional relationship between gross regional product per capita and average luminosity (shown in Figure 5) roughly suggest that, conditional on all baseline controls, a modern province with a historical Armenian share of 20 percent (90th percentile) is estimated to have 13 percent higher gross regional product per capita in 2000 than another province with no historical Armenian presence (10th percentile). At the average province income, this effect corresponds to almost $310 per capita. Like for population density, the estimates for Armenian presence are sensitive to the omission of elevation and ruggedness, possibly reflecting the downward bias due to negative selection into high altitude areas.

The estimated relationship between Greek share and mean luminosity is also positive and significant at the 1 percent level.[28] The point estimate is similar in magnitude to that of Armenian population. A move from 10th to the 90th percentile in the population distribution implies an increase in luminosity by 35 percent. Translating this magnitude into regional income, we can roughly conclude that conditional on baseline controls, a modern province with a historical Greek share of 26 percent (90th percentile) is estimated to have more than 17 percent higher gross regional product per capita in 2000 than another province with no historical Greek presence (10th percentile). At the average province income, this effect corresponds to more than $400 per capita.[29]

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[28]In Figure 9 we provide the residual scatter plots describing the partial correlations between minority shares and average luminosity. Both plots are based on the baseline model in the last column of Table 4. They suggest that the associations we report in the table are not driven by influential outliers.

[29]In panel C of the Appendix Table A.1, we replicate the analysis in Table 4 using an alternative specification where independent variables of interest are log minority population sizes instead of minority shares. Also, we control for log total population in 1893 instead of our proxy for population density in 1893. The results are qualitatively similar to those in Table 4, except that the positive association between luminosity and historical Armenian population size is statistically significant across all the columns in Table A.1 regardless of whether we control for average elevation and ruggedness.

TABLE 4: Historical Minority Shares and Average Luminosity in 2000

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) OLS	(8) OLS
	Log(Average Luminosity in 2000)							
Armenian population share, 1893	-0.164	0.792	0.721	1.088**	1.199**	1.140**	1.118**	1.318***
	[0.549]	[0.582]	[0.629]	[0.483]	[0.470]	[0.475]	[0.461]	[0.441]
Greek population share, 1893	2.304***	2.052***	2.027***	1.387***	1.212***	1.210***	1.524***	1.357***
	[0.455]	[0.478]	[0.480]	[0.379]	[0.363]	[0.364]	[0.373]	[0.394]
Proxy for population density in 1893	0.029	-0.033	-0.036	-0.074	-0.075	-0.074	-0.053	-0.097*
	[0.112]	[0.096]	[0.095]	[0.079]	[0.083]	[0.084]	[0.079]	[0.055]
Observations	765	765	765	765	765	765	765	765
Adjusted R-squared	0.097	0.131	0.130	0.325	0.356	0.356	0.387	0.417
Effect of increasing Armenian share	-3.259	15.763	14.350	21.650**	23.852**	22.689**	22.241**	26.231***
from the 10-th to the 90-th percentile	[10.934]	[11.588]	[12.520]	[9.613]	[9.345]	[9.442]	[9.176]	[8.780]
Effect of increasing Greek share	59.557***	53.042***	52.391***	35.843***	31.325***	31.272***	39.395***	35.066***
from the 10-th to the 90-th percentile	[11.749]	[12.344]	[12.411]	[9.790]	[9.377]	[9.420]	[9.652]	[10.196]
Modern region dummies		✓	✓	✓	✓	✓	✓	
Longitude & Latitude			✓	✓	✓	✓	✓	✓
Average Elevation & Ruggedness				✓	✓	✓	✓	✓
Lake, sea and major rivers					✓	✓	✓	✓
Temperature & Precipitation						✓	✓	✓
Suitability to cultivation							✓	✓
Modern subregion dummies								✓

Finally, to show that our results are qualitatively unaffected when we use a larger sample, which includes the regions where the Ottoman census was incomplete, the Appendix Table A.4 replicates Table 4 using estimated figures for uncounted populations.

4.4.2 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 share regressions in Table 4 are presented in Table 5. 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
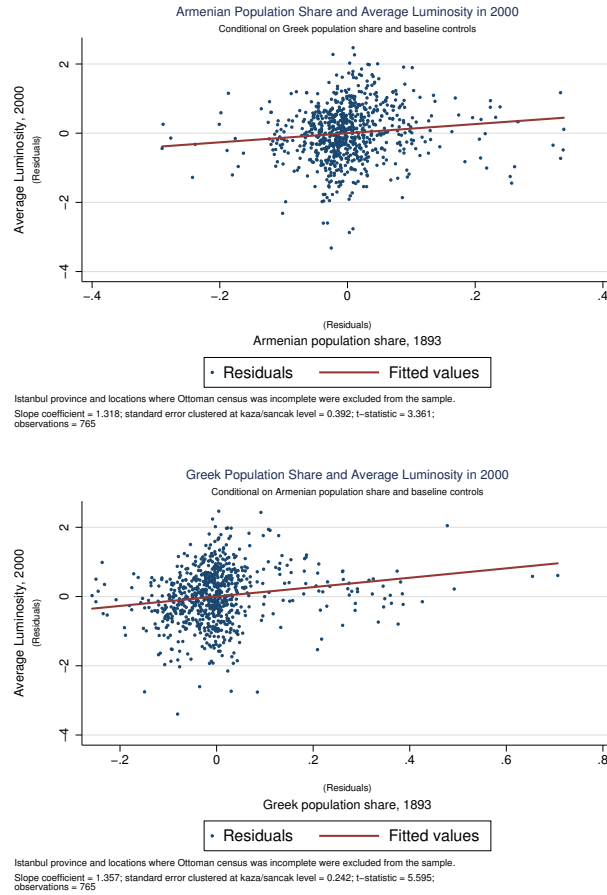
FIGURE 9: Added variable plots depicting the partial correlations between minority shares and luminosity

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.[30] 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 coefficients on Armenian and Greek population shares remain significant. However, the estimated magnitudes are 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 20 percent instead of 26 percent. Results are qualitatively similar for Greeks. The marginal effects corresponding to a 10th-to-90th percentile move becomes weaker, 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 by 8 percentage points, i.e., from 35 down to 27 percent.

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

The reductions in the coefficients on minority populations reflect the fact that, other things equal, both the Armenians and Greeks were systematically more likely 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 presence and contemporary development we document in Table 4.

TABLE 5: Minority Shares and Average Luminosity, Robustness to Historical Correlates of Economic Development

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) OLS
	Log(Average Luminosity in 2000)						
Armenian population share, 1893	1.318***	1.007**	1.317***	1.379***	1.071**	1.175***	0.806*
	[0.441]	[0.404]	[0.440]	[0.463]	[0.437]	[0.437]	[0.415]
Greek population share, 1893	1.357***	1.049***	1.338***	1.167***	1.279***	1.249***	0.818**
	[0.394]	[0.386]	[0.370]	[0.367]	[0.399]	[0.370]	[0.337]
Proxy for population density in 1893	-0.097*	-0.076	-0.098*	-0.097*	-0.062	-0.103*	-0.065
	[0.055]	[0.061]	[0.054]	[0.057]	[0.059]	[0.055]	[0.066]
Observations	765	765	765	765	765	765	765
Adjusted R-squared	0.417	0.460	0.423	0.430	0.419	0.426	0.478
Effect of increasing Armenian share	26.231***	20.032**	26.199***	27.434***	21.319**	23.389***	16.032*
from the 10-th to the 90-th percentile	[8.780]	[8.034]	[8.759]	[8.777]	[9.212]	[8.688]	[8.248]
Effect of increasing Greek share	35.066***	27.105***	34.572***	30.168***	33.061***	32.272***	21.141**
from the 10-th to the 90-th percentile	[10.196]	[9.975]	[9.575]	[9.473]	[10.319]	[9.568]	[8.722]
Modern subregion dummies	✓	✓	✓	✓	✓	✓	✓
Other baseline controls	✓	✓	✓	✓	✓	✓	✓
Railroad in 1910 & Major 19th century port		✓					✓
WW1 casualties & Distance to war front (1919-1922)			✓				✓
Number of settled immigrants (1921-1929)				✓			✓
In central kaza/sancak					✓		✓
Log distances to Istanbul & nearest national border						✓	✓

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 (Davis and Weinstein, 2002; Miguel and Roland, 2011), 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 5 reports the results conditional on our war exposure measures. Conditional on our exogenous baseline controls, distance to war fronts over the period 1919-1922 has a positive, albeit weakly significant, relationship with average luminosity in 2000. This is consistent with priors. Regions with higher number of WW1 soldier casualties, on the other hand, do not enjoy a significantly different level of economic development in 2000. 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 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 5, 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 shares remain significant at the 1 percent level. Also importantly, comparing columns 1 and 4, the estimated magnitudes for minority population shares 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 both historical evidence and our own regression analysis of settlement patterns (not shown here). 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 5 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.[31] The coefficient on this indicator has a positive sign, but it is insignificant, possibly because the baseline controls already account for some of the main characteristics that determined the location of these centers. In all panels, the population shares of Armenian and Greeks remain highly significant. The predicted changes in luminosity –reported at the bottom of each panel– in response to higher

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

minority presence are somewhat smaller in percentage terms, but they do not wildly differ from the baseline magnitudes.

Proximity to Istanbul as the historical capital of the Ottoman Empire and the most important economic center (both now and in the past) of Turkey is a strong predictor of economic activity today. Historically, the forces of attraction towards this economic hub were almost certainly stronger for Greeks and Armenians than it was for Muslims –relative to their overall representation in the Ottoman population. Other things equal, proximity to national borders may influence the degree and types of economic activity. Since we do not want to attribute such a largely contemporary effect to a systematic or purely coincidental clustering of minority populations in regions close to borders. To address these concerns, in column 6, we control for distances to Istanbul and the nearest national border. Indeed, as expected, luminosity decreases with both of the distance variables. The coefficient estimate for distance to Istanbul is highly significant, while distance to nearest national border is not significant at conventional levels. Again in line with the above positive selection story, point estimates for both minority share variables somewhat decline vis-a-vis the baseline model in column 1. Reassuringly, however, these changes are not too large and both Greek and Armenian presence survive as highly significant predictors of economic activity.

Finally, in the last column of Table 5, all robustness controls are added to the baseline model simultaneously. The results from this full specification suggest that even in the presence of a fairly exhaustive list of potential confounders, our main conclusions about minority presence remain unchanged. Both Greek and Armenian population shares (conditional on historical population density) are positive and significant predictors of economic development. While Armenian share loses some of its significance, it remains significant at the 10 percent level. Greek share on the other hand is significant at the 5 percent level. As expected, the estimated marginal effects under this very stringent specification are remarkably lower than those reported in column 1. Thus, assuming the presence of a causal link, we consider the magnitudes reported in column 7 as lower bounds for the influence of historical Armenian and Greek presence on regional development. According to these estimates, a region that was at the 90th percentile of the Armenian population share 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 more than 21 percent.

Selection on Observables and Unobservables. Following the method developed by Altonji et al. (2005), we exploit the idea that the degree of selection on the unobserved variables in a model can be inferred from the degree of selection on the observed explanatory variables. This method allows us to assess how much larger the selection bias from unobserved heterogeneity should be, relative to the bias from selection on observables, in order to fully explain away the entire coefficients on our main variables of interest. In particular, we examine the absolute magnitude of the ratio, $\hat{\alpha}^F / (\hat{\alpha}^R - \hat{\alpha}^F)$, where $\hat{\alpha}^R$ is our estimate from a restricted model and $\hat{\alpha}^F$ is the estimate from another specification (the full specification) that nests the restricted model. Intuitively, a higher absolute value for this ratio means that the additional control variables added to the restricted

model –to obtain the full model–, are not sufficient to explain away the estimated coefficients on Armenian and Greek shares in the full specification. Thus, these coefficients cannot be completely attributed to omitted-variable bias unless the amount of selection on unobservables is much larger than that on observables. In Table 6 below we present these ratios both for Armenian and Greek shares under several pairs of restricted and full specifications.

TABLE 6: Assessing potential selection bias from unobserved heterogeneity

| | $|\hat{\alpha}^F/(\hat{\alpha}^R - \hat{\alpha}^F)|$ for | |
	Armenian share	Greek share
Table 4		
R: (2), F: (3)	10.15	81.08
R: (2), F: (4)	3.68	2.09
R: (2), F: (5)	2.95	1.44
R: (2), F: (6)	3.28	1.44
R: (2), F: (7)	3.43	2.89
Table 5		
R: (1), F: (2)	3.24	3.41
R: (1), F: (3)	1317.00	70.42
R: (1), F: (4)	22.61	6.14
R: (1), F: (5)	4.34	16.40
R: (1), F: (6)	8.22	11.56
R: (1), F: (7)	1.57	1.52

We first assess the strength of a potential selection on unobservables for our baseline table (Table 4) where we successively add controls for various geographical features and climatic conditions. We fix Column 2 as our restricted model and retain region dummies in all models that we compare. Depending on what we consider as the full specification, the resulting ratios of relevance range between 2.95 and 10.15 for Armenian share and between 1.44 and 81.08 for Greek share. Looking at the relative change in coefficient estimates as we move from the most restricted (Column 2) to the least restricted model (Column 7) that includes all of our exogenous controls, we conclude that selection on unobservables would have to be at least 3.43 times larger than selection on observables, in order for our estimated coefficient on Armenian share in Column 7 to be entirely attributable to selection on unobservables. The corresponding figure is 2.89 for Greek share.

We repeat the same analysis for our robustness table (Table 5) where we control for various sets of potentially endogenous historical correlates of development. There, we fix Column 1 as our restricted model which corresponds to the full baseline specification in Table 4 that includes subregion dummies instead of region dummies. We consider each of Columns 2–6 in Table 5 as our full specification. The relevant ratios range between 3.24 and 1317 for Armenians and 3.41 and 70.42 for Greeks. Even when we control for the full set of robustness variables and consider

Column 7 as our full specification, it appears that selection on unobservables needs to be at least 1.57 times larger than selection on observables in order to fully explain away the coefficient on historical Armenian share. The magnitude is similar (1.52) for Greeks.

5 Potential Channels of Persistence

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 partly reflecting the persistent influence of the higher rate of physical and human capital accumulation among the non-Muslim subjects of the empire. In this section we offer suggestive evidence for these two main channels.

5.1 Confiscation of Minority Assets and the Rise of Muslim Capital

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).[32]

Using a simple model provided in Appendix B, we 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. We argue that unequal capture of minority assets not only led to greater asset and

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[32]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).

wealth disparity among remaining Muslims, but it also facilitated investment on physical capital by the newly emerging Muslim bourgeoisie and consequently gave to regions with greater historical minority presence an advantage in establishing more viable businesses and larger scale industries over the early years of the Turkish Republic.

The goal of this section is to take this hypothesis to data. Using district-level information on land holdings of households in 1997 we first investigate whether the expulsion of Armenian and Greek minorities had any persistent effect on inequality in land holdings.[33] In the first column of Table 7 we estimate the relationship between historical minority shares and the gini index for land holdings by households conditional on our baseline controls. In column 4, we repeat the same analysis using the full specification that includes all of our robustness controls. Both Armenian and Greek presence are positive and significant predictors of contemporary land inequality, which we argue is a proxy for concentration of asset holdings and wealth. A move from 10th to the 90th percentile in the cross-regional distribution of the share of Armenians before the deportations is associated with around 2.7 percentage points –or around 0.24 standard deviations– increase in the land Gini coefficient. The corresponding change for the Greek population is very similar in magnitude.

Overall, the results in columns 1 and 4 are supportive of the first part of our asset transfer hypothesis. One reason why historical minority shares predict land Gini in 1997 is that minorities were holding a disproportionately larger share of land vis-a-vis their representation in the population. As our simple model illustrates, the resulting historical inequality in land holdings persisted over time due to the unequal redistribution of confiscated lands and other property after the expulsions.

The second part of our hypothesis suggests that the concentration of land holdings should be positively correlated with investment in physical capital and hence with economic activity. This correlation could be due to two main reasons which are not mutually exclusive. One reason could be the direct effect of inequality in land holdings and other valuable property on wealth concentration which in turn might have facilitated investment especially during the early stages of Turkish economic development when capital was scarce and financing constraints were more binding. The second reason could be that land inequality also mirrors the amount of productive assets (shops, factories etc.) in high minority regions. If, as we previously argued, these assets remained concentrated in the hands of a few influential households it might eventually result in greater inequality in land holdings as well. Consequently, land inequality would predict higher economic activity as a proxy for the amount of expropriated physical capital which in turn might have given high minority regions a head start position in the process of industralization and regional development.

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[33]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.

TABLE 7: Minority Share, Land Inequality in 1997 and Average Luminosity in 2000

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
	Land Gini	Avg. Luminosity		Land Gini	Avg. Luminosity	
Armenian population share, 1893	0.144***	1.297***	1.096**	0.140***	0.798*	0.624
	[0.045]	[0.445]	[0.434]	[0.045]	[0.418]	[0.415]
Greek population share, 1893	0.103***	1.398***	1.253***	0.108***	0.868***	0.734**
	[0.030]	[0.397]	[0.393]	[0.030]	[0.332]	[0.331]
Proxy for population density in 1893	-0.009*	-0.098*	-0.085*	-0.012**	-0.071	-0.056
	[0.005]	[0.055]	[0.051]	[0.006]	[0.065]	[0.060]
Land Gini			1.400***			1.245***
			[0.356]			[0.341]
Observations	759	759	759	759	759	759
Adjusted R-squared	0.241	0.419	0.435	0.251	0.477	0.489
Effect of increasing Armenian share	2.758***	24.999***	21.127**	2.685***	15.370*	12.018
from the 10-th to the 90-th percentile	[0.859]	[8.578]	[8.370]	[0.866]	[8.064]	[8.003]
Effect of increasing Greek share	2.662***	36.130***	32.394***	2.783***	22.436***	18.963**
from the 10-th to the 90-th percentile	[0.767]	[10.256]	[10.161]	[0.777]	[8.581]	[8.551]
Modern subregion dummies	✓	✓	✓	✓	✓	✓
Other baseline controls	✓	✓	✓	✓	✓	✓
Historical correlates of development				✓	✓	✓

Both explanations imply that land inequality (i) should predict higher luminosity and (ii) as a mediating variable it should explain away part of the positive correlations between minority shares and average luminosity once it is included in our model. Columns 2 and 3 confirm that this is indeed the case. In column 3, land Gini is positively correlated with economic activity, a relationship that is highly significant. Also, adding it to the right hand side leads to a reduction in both Greek and Armenian coefficients. Greek share remains significant at the 1 percent level, and Armenian share is significant at the 5 percent level albeit losing some of its significance compared to column 2. The reductions in marginal effects reported at the bottom of the table are quite moderate. This could mean that the indirect effect of minority presence that is mediated through the asset transfer channel is not very sizable, but it could also mean that land inequality measure simply captures only a small part of the mediating effects we would have identified for the asset transfer mechanism, if we had better proxies for the historical stock of minority assets at the district level.

We conduct Sobel-Goodman test to see whether the reductions in the point estimates for minority shares –after controlling for land Gini– are statistically significant. The sizes of these so called 'indirect' effects of Armenian and Greek presence that go through our land Gini variable are

reported in Table 8 along with their standard errors.[34] The test results are reported both for the baseline model in column 3 and the full specification in column 6. Either ways, the mediated effects are statistically significant at the 5 percent level. The fraction of the total 'Armenian effect' on luminosity that is mediated by land holding Gini is 14 to 19 percent depending on the specification. The corresponding fractions are somewhat lower (10 to 15 percent) for Greeks.

TABLE 8: Minority Presence and Average Luminosity: Mediating Role of Asset Transfer Channel in Explaining Contemporary Economic Activity

		Mediating variable: Land inequality, 1997	
		Baseline specification	Full Specification
Armenian share	**Direct effect**	1.146*** [0.412]	0.674 [0.420]
	Mediated effect	0.187** [0.079]	0.161** [0.081]
	Fraction of total effect mediated	0.14	0.19
Greek share	**Direct effect**	1.241*** [0.257]	0.715*** [0.258]
	Mediated effect	0.140** [0.065]	0.131** [0.059]
	Fraction of total effect mediated	0.10	0.15

5.2 Minorities and Human Capital Accumulation

Greeks and Armenians had a significant representation in the highly skilled and educated segment of the Ottoman society. High levels of investment in human capital among Armenians had historical roots. Under the reign of Bagratuni (885-1045) in Armenia Major and the Cilician Armenian Kingdom (1198-1375), Armenians enjoyed a period of persistent growth in science and culture. Elementary schools were subsidized by the state, and in the 9th and 10th centuries, Armenian state established institutions of higher education, called Vardapetarans, in large cities (Khachikyan, 2010). Even in the relatively poorer eastern provinces such as the Erzurum vilayet, the education level of the Armenian population and the knowhow of Armenian artisans stood out vis-a-vis the Muslims (Kévorkian, 2011).

While due to the lack of sufficient state investment in education and other social infrastructure in the eastern provinces, a significant majority of Muslims lacked adequate education and skills, Armenian philanthropic agencies and the religious institutions were quite effective in channeling the community resources into education. Ottoman administration's neglect of Anatolia, especially the Eastern regions, also deepened the inequities in the quality of educational institutions between non-Muslim minorities and the Muslim majority.

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[34]We used *sgmediation* module for STATA to carry out the Sobel-Goodman mediation tests. Reported significance levels are based on bootstrapped standard errors with case resampling.

In this section, we consider educational attainment as a potentially mediating variable between historical minority presence and contemporary economic development. There are several reasons to expect that education levels today would be higher in localities that were subject to greater Armenian and Greek influence in the past. One possible mechanism would be the diffusion of cultural values regarding the importance of education. This diffusion might have taken place through the observation by the local Muslim majority of the returns to education exemplified in the economic success of the more educated minority groups. Alternatively, higher demand for educated work force driven by the establishment of modern sectors by the minorities might have directly raised the level of human capital investment among the local Muslims or it could have generated incentives for more educated and highly skilled Muslims to migrate to regions with greater minority presence. Intergroup transmission of skills and knowledge in craftsmanship, trade and commerce might be another channel. Muslims working with or competing against non-Muslim minorities in the domestic market might have gained an advantage in adopting the knowhow and production techniques developed by Armenians and Greeks. Finally, the shops, businesses and other productive assets Greek and Armenians left behind might have generated the incentives and means to invest in human capital among local Muslims that took over these assets. This involuntary transfer of wealth and productive assets might have facilitated over the early years of Turkish Republic the emergence of a Muslim bourgeoisie with higher educational attainment. Intergenerational transmission of values regarding the importance of education would explain the persistence of higher levels of education into contemporary period.

The results in Table 9 are supportive of the education hypothesis. Historical Armenian and Greek presence is a significant and positive predictor of various measures of contemporary educational attainment at the district level.

The baseline results in column 1 suggest that an increase in Armenian share from 10th to the 90th percentile of the regional distribution –which corresponds to an increase from zero to 20 percent– is associated with an increase in the share of literates by about 1.86 percentage points. The corresponding increase in the share of population who completed a primary school, a high school (or equivalent vocational school) and a university are 1.29, 2.59 and 0.65 percentage points respectively. The results for Greeks are qualitatively similar. The estimated coefficients on the Greek share are smaller than those on Armenian share for lower levels of educational attainment (literacy and primary school completion), similar for high school completion and larger –almost twice as large– for university graduates. When other robustness controls are added, estimated magnitudes become somewhat smaller but they remain statistically significant for all outcome measures.

In Table 10 we regress average luminosity on minority shares and each of the individual educational attainment measure to see the extent to which the positive minority influence on economic development could be explained through accumulated human capital. Panel A presents results for literacy and primary school completion while panel B shows the results for high school and university graduation. The results are striking. Once we control for current education levels, the coefficient on Armenian share, a robust and positive predictor of economic activity at the

TABLE 9: Historical Minority Share and Education in 2000

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) OLS	(8) OLS
	Literacy		Primary school		High school		University	
Armenian population share, 1893	0.094***	0.060*	0.065**	0.043	0.130***	0.097***	0.033***	0.025***
	[0.031]	[0.032]	[0.027]	[0.028]	[0.030]	[0.031]	[0.008]	[0.008]
Greek population share, 1893	0.063***	0.034**	0.038***	0.025*	0.108***	0.081***	0.045***	0.037***
	[0.012]	[0.013]	[0.012]	[0.013]	[0.028]	[0.031]	[0.011]	[0.011]
Proxy for population density in 1893	-0.007***	-0.004	-0.003*	-0.000	-0.011***	-0.007*	-0.004***	-0.003**
	[0.002]	[0.003]	[0.002]	[0.002]	[0.003]	[0.004]	[0.001]	[0.001]
Observations	765	765	765	765	765	765	765	765
Adjusted R-squared	0.655	0.686	0.693	0.702	0.291	0.318	0.349	0.370
Effect of increasing Armenian share	1.858***	1.188*	1.287**	0.859	2.588***	1.916***	0.653***	0.505***
from the 10-th to the 90-th percentile	[0.619]	[0.632]	[0.543]	[0.551]	[0.599]	[0.615]	[0.151]	[0.159]
Effect of increasing Greek share	1.615***	0.886**	0.977***	0.650*	2.777***	2.086***	1.163***	0.952***
from the 10-th to the 90-th percentile	[0.322]	[0.347]	[0.302]	[0.337]	[0.734]	[0.787]	[0.272]	[0.295]
Modern subregion dummies	✓	✓	✓	✓	✓	✓	✓	✓
Other baseline controls	✓	✓	✓	✓	✓	✓	✓	✓
Historical correlates of development		✓		✓		✓		✓

district level, is noticeably reduced in magnitude and loses its statistical significance. Results are qualitatively similar for Greek share. Although our findings in Table 9 and Table 10 do not necessarily reflect a causal effect they nonetheless are consistent with a positive minority legacy on subsequent human capital accumulation and economic development. We repeat the Sobel-Goodman test of mediation for all education variables. Results are in Table 11. All mediated effects are significant at conventional levels except for the mediating role of primary education in explaining the link between historical Greek presence and contemporary luminosity. Of the total effect of Armenian presence, the fraction mediated by educational attainment ranges from 23 percent (for primary school completion) to 66 percent (for high school completion), depending on the level of education and the empirical specification. The fraction of total Greek effect that can be attributed to education, as an indirect channel, ranges from 13 percent (for primary school completion) to 71 percent (for university completion).

TABLE 10: Historical Minority Share, Education and Average Luminosity in 2000

	(1)	(2)	(3)	(4)	(5)	(6)
PANEL A	OLS	OLS	OLS	OLS	OLS	OLS
	Log(Average Luminosity in 2000)					
Armenian population share, 1893	1.318***	0.650	1.019**	0.806*	0.403	0.621
	[0.441]	[0.465]	[0.452]	[0.415]	[0.448]	[0.435]
Greek population share, 1893	1.357***	0.910**	1.182***	0.818**	0.587*	0.710**
	[0.394]	[0.376]	[0.390]	[0.337]	[0.325]	[0.328]
Proxy for population density in 1893	-0.097*	-0.046	-0.082	-0.065	-0.040	-0.064
	[0.055]	[0.048]	[0.053]	[0.066]	[0.059]	[0.065]
Literacy rate		7.133***			6.724***	
		[0.979]			[1.048]	
Primary education completion rate			4.609***			4.275***
			[0.786]			[0.807]
Observations	765	765	765	765	765	765
Adjusted R-squared	0.417	0.504	0.445	0.478	0.548	0.502
Effect of increasing Armenian share	26.231***	12.944	20.283**	16.032*	8.026	12.351
from the 10-th to the 90-th percentile	[8.780]	[9.257]	[8.986]	[8.248]	[8.909]	[8.647]
Effect of increasing Greek share	35.066***	23.517**	30.550***	21.141**	15.166*	18.357**
from the 10-th to the 90-th percentile	[10.196]	[9.718]	[10.079]	[8.722]	[8.408]	[8.478]

	(1)	(2)	(3)	(4)	(5)	(6)
PANEL B	OLS	OLS	OLS	OLS	OLS	OLS
	Log(Average Luminosity in 2000)					
Armenian population share, 1893	1.318***	0.531	0.752*	0.806*	0.276	0.404
	[0.441]	[0.428]	[0.409]	[0.415]	[0.411]	[0.394]
Greek population share, 1893	1.357***	0.706**	0.581*	0.818**	0.373	0.235
	[0.394]	[0.335]	[0.334]	[0.337]	[0.287]	[0.288]
Proxy for population density in 1893	-0.097*	-0.033	-0.032	-0.065	-0.028	-0.022
	[0.055]	[0.042]	[0.045]	[0.066]	[0.053]	[0.055]
High school completion rate		6.038***			5.492***	
		[0.610]			[0.595]	
University completion rate			17.203***			15.794***
			[1.487]			[1.371]
Observations	765	765	765	765	765	765
Adjusted R-squared	0.417	0.522	0.513	0.478	0.562	0.557
Effect of increasing Armenian share	26.231***	10.563	14.964*	16.032*	5.483	8.036
from the 10-th to the 90-th percentile	[8.780]	[8.510]	[8.136]	[8.248]	[8.174]	[7.840]
Effect of increasing Greek share	35.066***	18.253**	15.011*	21.141**	9.652	6.064
from the 10-th to the 90-th percentile	[10.196]	[8.663]	[8.638]	[8.722]	[7.428]	[7.449]
Modern subregion dummies	✓	✓	✓	✓	✓	✓
Other baseline controls	✓	✓	✓	✓	✓	✓
Historical correlates of development				✓	✓	✓

6 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. 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.

Table 11: Minority Shares and Average Luminosity: Mediating Role of Contemporary Education in Explaining Economic Activity

		Baseline specification				Full specification			
	Mediating variable:	Literacy	Primary school	High School	University	Literacy	Primary school	High School	University
Armenian share	Direct effect	0.650* [0.378]	1.019** [0.420]	0.531 [0.404]	0.752* [0.387]	0.403 [0.385]	0.621 [0.418]	0.276 [0.404]	0.404 [0.388]
	Mediated effect	0.668*** [0.211]	0.299** [0.117]	0.787*** [0.185]	0.566*** [0.134]	0.402** [0.195]	0.185* [0.112]	0.530*** [0.163]	0.402*** [0.133]
	Fraction of total effect mediated	0.51	0.23	0.60	0.43	0.50	0.23	0.66	0.50
Greek share	Direct effect	0.910*** [0.236]	1.182*** [0.257]	0.706*** [0.258]	0.581** [0.264]	0.587** [0.235]	0.710*** [0.250]	0.373 [0.232]	0.235 [0.239]
	Mediated effect	0.447*** [0.106]	0.175** [0.071]	0.650*** [0.156]	0.776*** [0.158]	0.231** [0.101]	0.108 [0.068]	0.444*** [0.153]	0.583*** [0.155]
	Fraction of total effect mediated	0.33	0.13	0.48	0.57	0.28	0.13	0.54	0.71

We offer evidence on two main channels through which Armenian and Greek presence might have shaped the regional outcomes. In particular, we show that current residents of districts with greater exposure to Greek and Armenian presence are more educated today. This result might be a systematic indication of the positive externalities created by Armenian and Greek human capital on Muslim co-residents in the same localities. Alternatively, it could reflect the persistence of the high return on education driven by the concentration of high value added economic activities pioneered by minorities. Finally we show that land inequality was greater in localities with greater minority concentration. We have argued that this is consistent with an asset transfer story.

The main concern with identification was that the OLS results may not necessarily reflect the persistence of the initial differences in regional development that were *caused* by the historical settlement patterns of the minorities centuries ago. Instead, they may merely be capturing 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. While we argue that in the presence of a rich set of controls and sub-region fixed effects, selection is unlikely to explain away the significant and sizable correlations we document, in future work we hope to complement our OLS analysis with an instrumental variables analysis.

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Appendices

A Supplementary Results

TABLE A.1: Historical Minority Size and Contemporary Outcomes in 2000

PANEL A	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) OLS	(8) OLS
	Log(Population Density in 2000)							
Log Armenian population, 1881-1893	0.022	0.041**	0.033*	0.034**	0.043***	0.047***	0.047***	0.041***
	[0.017]	[0.019]	[0.019]	[0.015]	[0.014]	[0.015]	[0.014]	[0.014]
Log Greek population, 1881-1893	0.086***	0.081***	0.084***	0.046**	0.035**	0.036**	0.040**	0.029
	[0.017]	[0.021]	[0.021]	[0.018]	[0.017]	[0.017]	[0.018]	[0.018]
Log total population, 1881-1893	-0.078	-0.124	-0.093	-0.031	-0.033	-0.049	-0.051	0.044
	[0.116]	[0.106]	[0.113]	[0.101]	[0.101]	[0.099]	[0.096]	[0.084]
Observations	765	765	765	765	765	765	765	765
Adjusted R-squared	0.068	0.109	0.113	0.290	0.317	0.318	0.329	0.355
Effect of increasing Armenian population	20.180	38.008**	30.528*	31.179**	39.956***	43.826***	43.405***	37.917***
from the 10-th to the 90-th percentile	[15.434]	[17.459]	[17.267]	[13.528]	[12.705]	[13.972]	[13.416]	[12.652]
Effect of increasing Greek population	85.600***	80.753***	83.327***	45.703**	35.352**	36.052**	39.428**	28.933
from the 10-th to the 90-th percentile	[17.185]	[20.811]	[20.824]	[18.070]	[17.209]	[17.407]	[17.801]	[17.861]

PANEL B	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) OLS	(8) OLS
	Urbanization Rate in 2000							
Log Armenian population, 1881-1893	0.007**	0.006*	0.005*	0.005*	0.006**	0.008***	0.008***	0.009***
	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
Log Greek population, 1881-1893	0.007**	0.008**	0.008**	0.005*	0.005	0.005	0.005*	0.005
	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]	[0.003]
Log total population, 1881-1893	-0.001	0.004	0.002	0.007	0.006	0.005	0.005	0.014
	[0.020]	[0.019]	[0.020]	[0.019]	[0.019]	[0.017]	[0.017]	[0.017]
Observations	765	765	765	765	765	765	765	765
Adjusted R-squared	0.023	0.028	0.028	0.057	0.060	0.072	0.078	0.096
Effect of increasing Armenian share	6.160**	5.127*	5.096*	4.883*	5.619**	7.159***	7.097***	8.162***
from the 10-th to the 90-th percentile	[2.571]	[2.726]	[2.867]	[2.664]	[2.664]	[2.704]	[2.704]	[2.986]
Effect of increasing Greek share	6.505**	7.978**	8.127***	5.361*	4.680	4.593	5.089*	4.750
from the 10-th to the 90-th percentile	[2.812]	[3.169]	[3.143]	[3.182]	[3.195]	[3.032]	[3.065]	[3.226]

PANEL C	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) OLS	(8) OLS
	Log(Average Luminosity in 2000)							
Log Armenian population, 1881-1893	0.025	0.041**	0.036*	0.028*	0.038***	0.037**	0.037**	0.047***
	[0.017]	[0.019]	[0.020]	[0.016]	[0.015]	[0.016]	[0.015]	[0.015]
Log Greek population, 1881-1893	0.118***	0.094***	0.097***	0.066***	0.055***	0.056***	0.061***	0.048***
	[0.018]	[0.020]	[0.019]	[0.019]	[0.017]	[0.017]	[0.016]	[0.016]
Log total population, 1881-1893	-0.107	-0.150	-0.145	-0.073	-0.079	-0.079	-0.082	-0.065
	[0.115]	[0.102]	[0.105]	[0.093]	[0.094]	[0.093]	[0.087]	[0.085]
Observations	765	765	765	765	765	765	765	765
Adjusted R-squared	0.130	0.146	0.147	0.329	0.364	0.362	0.389	0.419
Effect of increasing Armenian	23.275	37.756**	33.159*	26.068*	35.667***	34.779**	34.133**	43.637***
from the 10-th to the 90-th percentile	[16.272]	[17.935]	[18.595]	[15.050]	[13.561]	[14.528]	[13.557]	[13.726]
Effect of increasing Greek	117.430***	94.142***	96.641***	65.993***	55.425***	55.514***	60.689***	47.974***
from the 10-th to the 90-th percentile	[18.022]	[19.523]	[19.365]	[18.699]	[16.961]	[16.909]	[16.401]	[15.741]

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Modern region dummies		✓	✓	✓	✓	✓	✓	
Longitude & Latitude			✓	✓	✓	✓	✓	✓
Average Elevation & Ruggedness				✓	✓	✓	✓	✓
Lake, sea and major rivers					✓	✓	✓	✓
Temperature & Precipitation						✓	✓	✓
Suitability to cultivation							✓	✓
Modern subregion dummies								✓

TABLE A.2: Historical Minority Shares and Population Density in 2000: Robustness to including regions with incomplete census counts

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) OLS	(8) OLS
	Log(Population Density in 2000)							
Armenian population share, 1881-1893	-0.407	1.034	0.867	1.064*	1.258**	1.199**	1.191**	1.234***
	[0.612]	[0.639]	[0.673]	[0.559]	[0.514]	[0.511]	[0.489]	[0.441]
Greek population share, 1881-1893	1.888***	1.682***	1.731***	1.083***	0.856**	0.923***	1.130***	1.058***
	[0.528]	[0.506]	[0.499]	[0.369]	[0.342]	[0.343]	[0.359]	[0.395]
Proxy for population density in 1893	0.043	-0.038	-0.044	-0.111	-0.119*	-0.121	-0.111	-0.106**
	[0.087]	[0.089]	[0.090]	[0.069]	[0.071]	[0.076]	[0.072]	[0.053]
Observations	877	877	877	877	877	877	877	877
Adjusted R-squared	0.062	0.121	0.126	0.307	0.332	0.337	0.350	0.375
Effect of increasing Armenian share	-8.598	21.848	18.322	22.488*	26.582**	25.332**	25.175**	26.069***
from the 10-th to the 90-th percentile	[12.941]	[13.502]	[14.223]	[11.823]	[10.853]	[10.799]	[10.327]	[9.324]
Effect of increasing Greek share	48.291***	43.014***	44.279***	27.703***	21.899**	23.620***	28.914***	27.053***
from the 10-th to the 90-th percentile	[13.493]	[12.934]	[12.752]	[9.448]	[8.759]	[8.765]	[9.180]	[10.097]
Modern region dummies		✓	✓	✓	✓	✓	✓	
Longitude & Latitude			✓	✓	✓	✓	✓	✓
Average Elevation & Ruggedness				✓	✓	✓	✓	✓
Lake, sea and major rivers					✓	✓	✓	✓
Temperature & Precipitation						✓	✓	✓
Suitability to cultivation							✓	✓
Modern subregion dummies								✓

TABLE A.3: Historical Minority Shares and Urbanization Rate in 2000: Robustness to including regions with incomplete census counts

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) OLS	(8) OLS
	Urbanization Rate in 2000							
Armenian population share, 1881-1893	0.183*	0.276***	0.316***	0.333***	0.358***	0.379***	0.378***	0.483***
	[0.093]	[0.097]	[0.106]	[0.098]	[0.097]	[0.089]	[0.089]	[0.101]
Greek population share, 1881-1893	0.246***	0.247***	0.245***	0.193***	0.187***	0.186***	0.208***	0.194***
	[0.069]	[0.070]	[0.067]	[0.059]	[0.056]	[0.056]	[0.058]	[0.066]
Proxy for population density in 1893	-0.025*	-0.024*	-0.023*	-0.029**	-0.029**	-0.029***	-0.028***	-0.025***
	[0.014]	[0.013]	[0.013]	[0.011]	[0.012]	[0.011]	[0.010]	[0.010]
Observations	877	877	877	877	877	877	877	877
Adjusted R-squared	0.034	0.039	0.041	0.072	0.077	0.085	0.089	0.095
Effect of increasing Armenian share	3.860**	5.830***	6.688***	7.030***	7.557***	8.001***	7.983***	10.205***
from the 10-th to the 90-th percentile	[1.961]	[2.045]	[2.249]	[2.073]	[2.048]	[1.891]	[1.872]	[2.140]
Effect of increasing Greek share	6.297***	6.316***	6.268***	4.936***	4.772***	4.754***	5.332***	4.959***
from the 10-th to the 90-th percentile	[1.775]	[1.801]	[1.702]	[1.510]	[1.429]	[1.430]	[1.474]	[1.679]
Modern region dummies		✓	✓	✓	✓	✓	✓	
Longitude & Latitude			✓	✓	✓	✓	✓	✓
Average Elevation & Ruggedness				✓	✓	✓	✓	✓
Lake, sea and major rivers					✓	✓	✓	✓
Temperature & Precipitation						✓	✓	✓
Suitability to cultivation							✓	✓
Modern subregion dummies								✓

TABLE A.4: Historical Minority Shares and Average Luminosity in 2000: Robustness to including regions with incomplete census counts

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) OLS	(8) OLS
	Log(Average Luminosity in 2000)							
Armenian population share, 1881-1893	-0.571	0.917	1.008	1.042*	1.273**	1.239**	1.230**	1.085**
	[0.655]	[0.629]	[0.654]	[0.580]	[0.547]	[0.538]	[0.524]	[0.502]
Greek population share, 1881-1893	2.497***	2.084***	2.115***	1.445***	1.251***	1.244***	1.512***	1.346***
	[0.468]	[0.470]	[0.471]	[0.388]	[0.369]	[0.370]	[0.379]	[0.396]
Proxy for population density in 1893	0.035	-0.002	-0.002	-0.070	-0.077	-0.075	-0.062	-0.092**
	[0.104]	[0.086]	[0.087]	[0.065]	[0.068]	[0.070]	[0.065]	[0.046]
Observations	877	877	877	877	877	877	877	877
Adjusted R-squared	0.106	0.156	0.155	0.342	0.371	0.370	0.392	0.418
Effect of increasing Armenian share	-12.109	19.439	21.364	22.079*	26.978**	26.264**	26.059**	22.991**
from the 10-th to the 90-th percentile	[13.880]	[13.332]	[13.862]	[12.282]	[11.590]	[11.401]	[11.104]	[10.641]
Effect of increasing Greek share	64.037***	53.465***	54.250***	37.065***	32.097***	31.913***	38.792***	34.513***
from the 10-th to the 90-th percentile	[11.995]	[12.048]	[12.080]	[9.949]	[9.472]	[9.485]	[9.720]	[10.167]
Modern region dummies		✓	✓	✓	✓	✓	✓	
Longitude & Latitude			✓	✓	✓	✓	✓	✓
Average Elevation & Ruggedness				✓	✓	✓	✓	✓
Lake, sea and major rivers					✓	✓	✓	✓
Temperature & Precipitation						✓	✓	✓
Suitability to cultivation							✓	✓
Modern subregion dummies								✓

TABLE A.5: Minority Population Size and Average Luminosity, Robustness to Historical Correlates of Economic Development

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) OLS
	Log(Average Luminosity in 2000)						
Log Armenian population, 1881-1893	0.047***	0.034**	0.050***	0.050***	0.045***	0.043***	0.034**
	[0.015]	[0.014]	[0.015]	[0.015]	[0.015]	[0.014]	[0.014]
Log Greek population, 1881-1893	0.048***	0.045***	0.047***	0.044***	0.044***	0.048***	0.039**
	[0.016]	[0.016]	[0.015]	[0.015]	[0.015]	[0.016]	[0.015]
Log total population, 1881-1893	-0.065	-0.103	-0.079	-0.098	-0.102	-0.045	-0.145*
	[0.085]	[0.074]	[0.081]	[0.078]	[0.098]	[0.082]	[0.085]
Observations	765	765	765	765	765	765	765
Adjusted R-squared	0.419	0.462	0.426	0.433	0.420	0.431	0.483
Effect of increasing Armenian share	43.637***	31.985**	46.279***	46.657***	41.465***	39.698***	31.884**
from the 10-th to the 90-th percentile	[13.726]	[13.236]	[13.952]	[13.712]	[13.875]	[13.163]	[12.992]
Effect of increasing Greek share	47.974***	45.166***	47.346***	43.484***	43.834***	48.372***	38.708**
from the 10-th to the 90-th percentile	[15.741]	[16.039]	[15.424]	[15.463]	[15.279]	[16.199]	[15.339]
Modern subregion dummies	✓	✓	✓	✓	✓	✓	✓
Other baseline controls	✓	✓	✓	✓	✓	✓	✓
Railroad in 1910 & Major 19th century port			✓				✓
WW1 casualties & Distance to war front (1919-1922)				✓			✓
Number of settled immigrants (1921-1929)					✓		✓
In central kaza/sancak						✓	✓
Log distances to Istanbul & nearest national border						✓	✓

B   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 the 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

$$\lambda_2^i = n_2^i / N_2 = \frac{n_2^i / N_1}{1 - \lambda_1^n + n_2^i / N_1} = \frac{1}{1 + \frac{(1 - \lambda_1^n)}{n_2^i / N_1}} \tag{2}$$

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

$$\lambda_2^{rl} = \frac{s^e(N_1 - n_1^n)}{N_2} = \frac{s^e(N_1 - n_1^n)}{(1 - \lambda_1^n)N_1 + n_2^i} = \frac{s^e(1 - \lambda_1^n)}{(1 - \lambda_1^n) + n_2^i/N_1} = \frac{s^e}{1 + \frac{n_2^i/N_1}{(1-\lambda_1^n)}}. \tag{3}$$

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:

$$y_2^{rl} = y_1^m + \frac{\lambda_1^n N_1 y_1^n - n_2^i y_2^i}{s^e(N_1 - n_1^n)} = \frac{s^e(1 - \lambda_1^n)y_1^m + \lambda_1^n y_1^n - \frac{n_2^i}{N_1}y_2^i}{s^e(1 - \lambda_1^n)} \tag{4}$$

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

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

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

$$\bar{y}_1(\lambda_1^n) \equiv \lambda_1^n y_1^n + (1 - \lambda_1^n)y_1^m. \tag{6}$$

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

$$L_2(\lambda) = \begin{cases} L_2^i(\lambda) \equiv \phi(\lambda_1^n)\frac{y_2^i}{\bar{y}_1(\lambda_1^n)}\lambda & \text{if } \lambda \in [0, \lambda_2^i] \\ L_2^{pl}(\lambda) \equiv L_2^i(\lambda_2^i) + \phi(\lambda_1^n)\frac{y_1^m}{\bar{y}_1(\lambda_1^n)}(\lambda - \lambda_2^i) & \text{if } \lambda \in (\lambda_2^i, \lambda_2^i + \lambda_2^{pl}] \\ L_2^{rl}(\lambda) \equiv L_2^{pl}(\lambda_2^i + \lambda_2^{pl}) + \phi(\lambda_1^n)\frac{y_2^{rl}}{\bar{y}_1(\lambda_1^n)}\left[\lambda + \frac{s^e(1-\lambda_1^n)}{\phi(\lambda_1^n)} - 1\right] & \text{if } \lambda \in (\lambda_2^i + \lambda_2^{pl}, 1] \end{cases} \tag{7}$$

where

$$\phi(\lambda_1^n) = 1 - \lambda_1^n + \frac{n_2^i}{N_1} \tag{8}$$

$L_2(\lambda)$ 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

$$G = (\lambda_2^i + \lambda_2^{pl})(1 - L_2^i(\lambda_2^i)) - (1 - \lambda_2^i)L_2^{pl}(\lambda_2^i + \lambda_2^{pl}) \tag{9}$$

It is straightforward to show that

$$\frac{\partial \lambda_2^i}{\partial \lambda_1^n} > 0 \tag{10}$$

$$\lambda_2^i + \lambda_2^{pl} = \frac{n_2^i/N_1 + (1 - s^e)(1 - \lambda_1^n)}{n_2^i/N_1 + (1 - \lambda_1^n)} \tag{11}$$

$$\text{sign}\left(\frac{\partial(\lambda_2^i + \lambda_2^{pl})}{\partial \lambda_1^n}\right) = \text{sign}\left(\frac{s^e n_2^i}{N_1}\right) > 0 \tag{12}$$

$$L_2^i(\lambda_2^i) = \frac{(n_2^i/N_1)y_2^i}{\bar{y}_1(\lambda_1^n)} \tag{13}$$

$$\text{sign}\left(\frac{\partial L_2^i(\lambda_2^i)}{\partial \lambda_1^n}\right) = -\text{sign}\left(\frac{\partial \bar{y}_1}{\partial \lambda_1^n}\right) < 0. \tag{14}$$

Since

$$L_2^{pl}(\lambda_2^i + \lambda_2^{pl}) = \frac{(n_2^i/N_1)y_2^i + (1 - s^e)(1 - \lambda_1^n)y_1^m}{\bar{y}_1(\lambda_1^n)}, \tag{15}$$

we also have

$$\frac{\partial L_2^{pl}(\lambda_2^i + \lambda_2^{pl})}{\partial \lambda_1^n} < 0. \tag{16}$$

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:

$$\frac{\partial G}{\partial \lambda_1^n} > 0. \tag{17}$$

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 local Muslims who manage to receive some share from the confiscated properties, since

$$\frac{\partial G}{\partial s^e} = \frac{(1 - \lambda_1^n) \left[\frac{n_2^i}{N_1} y_2^i - y_1^n \right]}{\left(1 - \lambda_1^n + \frac{n_2^i}{N_1} \right) \bar{y}_1(\lambda_1^n)} < 0 \qquad (18)$$

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.

C   Data Appendix

C.1   Variable Definitions and Sources

Outcome Variables

Population density in 2000: Natural logarithm of district population per square kilometer. It is computed using the Turkish Population Census of 2000 and the surface area of each district as reported by the National Mapping Agency of Turkey under the Ministry of National Defense. Census results can be accessed through TurkStat's web application.

Urbanization rate in 2000: The share of district population in 2000 who lives within the municipal boundaries that define the district centers. It is computed using data on the Turkish Population Census of 2000 about the distribution of the population within and outside the district centers.

Average luminosity in 2000: The variable measures for the year 2000 the density of time-stable nighttime lights at the district level. The information on light density come from the Defense Meteorological Satellite Program's (DMSP) Operational Linescan System. DMSP 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. We

compute district level luminosity by averaging across all light density pixels that fall within the district boundaries.

Education outcomes in 2000: We use 2000 Census figures to compute district level literacy rates, as well as primary school, high school, and university completion rates among the population aged 6 and above. We exclude from this base population those respondents whose literacy/education status is unknown. Before 1997 compulsory primary education was 5 years long and the institutions of primary education were called primary school. After 1997 primary schools and middle schools were combined to institute 8 years of compulsory education, which was termed as primary education. Primary school completion rate is based on the total number of people (aged 6+) who either graduated from primary schools under the old system or from schools of primary education under the new system. High school graduates consist of those who completed either a high school or a vocational school that is equivalent to a high school. Census results can be accessed through TurkStat's web application.

Control Variables

Historical Population: In the construction of the historical population measures, we use data on Greek, Armenian and total population reported by the Population Census of the Ottoman Empire that was conducted during the period 1881-1893. The census measures were reported either at the kaza (Ottoman district) or independent sancak level (when there is no kaza designation). The variables measure for each modern district in 2000, the absolute size and the share in total population of Armenian and Greek inhabitants of the Ottoman location (kaza or sancak) that was matched with this district. In rare cases when a given modern district is matched with multiple Ottoman kazas, the minority population shares reflect the overall share of these populations in the combination of these kazas. 1881-1893 Ottoman Census was the first census where females were also counted. The census used several ethnic-confessional categories for the Christian population. The 1893 population data used in this study were published for the first time by Karpat (1985). Unfortunately, despite its ethnic heterogeneity, all Muslims were lumped into one category. As Karpat (1985) puts it, "These population records issued in 1893 represent the most complete and reliable Ottoman population figures compiled in the nineteenth century. Unlike earlier general population statistics, these gave precise and detailed information on the population of all areas, noting the districts and regions where the census was not completed and providing estimates for the areas not subjected to individual census and registration. The figures in these statistics were considered definitive and reliable and were used as a basis for official statistics concerning the Ottoman population and for subsequent administrative measures". Armenian and Greek shares of an Ottoman district i in 1893 is computed as

$$armshr_{i,1893} = \frac{armpop_{i,1893}}{pop_{i,1893}} \tag{19}$$

$$greshr_{i,1893} = \frac{grepop_{i,1893}}{pop_{i,1893}} \tag{20}$$

1893 census figures are reported for Ottoman districts (*kazas*), and information about their boundaries are not available. This makes it impossible to compute population density as the areas of *kaza* are not known. Therefore, we use the sum of areas of all modern districts that were name-matched to a given *kaza* as a proxy for total area of that *kaza*. Using this proxy we construct population density figures for each *kaza*.

In our main analysis we omit modern districts that were assigned to Ottoman locations which belong to regions (sancaks or vilayets) with incomplete counts in 1881-1893 Ottoman Census. In some of the tables in the Appendix, we present results that employ alternative measures of historical minority shares and population density. These measures use possibly unreliable sancak or vilayet level estimates for uncounted populations. We distribute the population estimate for a given sancak/vilayet among individual kazas in that sancak/vilayet in proportion to their relative contribution in total sancak/vilayet population. In particular, if the counted population of district i in vilayet k constitutes ω_i fraction of vilayet k's counted population, then the estimated population for Ottoman district i (kaza) is given by

$$popest_{i,1893} = countedpop_{i,1893} + \omega_i \times uncountedpopest_{k,1893} \tag{21}$$

where $countedpop_{i,1893}$ is the counted population of district i and $uncountedpopest_{k,1893}$ is the estimated number of uncounted people in sancak/vilayet k. Then we assume that all of the uncounted population was Muslim to construct adjusted estimates for the share of Armenian and Greek populations in district i:

$$armshrest_{i,1893} = \frac{armpop_{i,1893}}{popest_{i,1893}} \tag{22}$$

$$greshrest_{i,1893} = \frac{grepop_{i,1893}}{popest_{i,1893}} \tag{23}$$

Longitude and Latitude: The latitude and longitude of the district centers in degrees. The values are retrieved via the GPS Visualizer's address locator web application and utilizing the Bing Maps database on location names and coordinates.

Average Elevation and Ruggedness: Average and standard deviation of elevation of a district. Raw elevation data is downloaded from DIVA-GIS in Grid format. This data is a version of

the CGIAR SRTM dataset (originally provided at 3 seconds resolution) aggregated to 30 seconds resolution. Average elevation is simply the mean of the values corresponding to those elevation grids that fall within a given district. Ruggedness is the standard deviation across the same grids. They are computed using ArcGIS®software. The original variable is given in meters. In regressions we rescale average elevation and ruggedness by dividing these measures by 1000.

Lake: A dummy which takes a value of 1 if a lake overlaps (partly or partially) with the territory of the district and 0 otherwise. The shapefile is downloaded from DIVA-GIS in vector format. The primary source is the Digital Chart of the World. The spatial computations are made using ArcGIS®software.

Sea: A dummy which takes a value of 1 if a district is adjacent (touches) a sea body, i.e., Marmara Sea, Black Sea, Mediterranean Sea or Aegean Sea, and 0 otherwise. The shapefile is downloaded from DIVA-GIS in vector format. The primary source is the GADM database of Global Administrative Areas (version 1.0). The spatial computations are made using ArcGIS®software.

Major River: A dummy which takes a value of 1 if a major river goes through any part of the district territory and 0 otherwise. The shapefile for rivers is downloaded from DIVA-GIS in vector format. The primary source is the Digital Chart of the World. Major rivers are spatially selected by cross-checking with Turkey's Map of Rivers and Lakes created by Ramazan Saygili. The spatial computations are made using ArcGIS®software.

Mean annual temperature and precipitation: They show average annual temperature and precipitation over the period 1960-1990. Data for these climatic indicators are retrieved from GAEZ data portal and they are provided at the grid cell level. We compute averages across cells that fall within modern district boundaries using ArcGIS®software. Finally, we rescale the resulting averages by dividing by 1000.

Suitability for cultivation: This is a combined measure of suitability for main agricultural products in Turkey. It shows the maximum value of the indices of suitability for cultivation among the following eight crops that historically dominate agricultural production of Turkey: sugar beet, wheat, barley, olive, tobacco, potato, cotton, tea. The suitability data for these crops is borrowed from GAEZ data portal. We use crop suitability indices that are estimated for low input level rain-fed cereals. The index for each crop is provided for individual grid cells with values ranging between 0 and 10 000. We compute averages across the grid cells that fall within modern district

boundaries using ArcGIS®software. Finally, we rescale the resulting averages by dividing by 1000.

Railroad in 1910: A dummy which takes a value of 1 if a railroad went through the modern district boundaries back in 1910. The image file showing the Anatolian railroads in 1910 is downloaded here and digitized using ArcGIS®software. Distance and adjacency calculations are also made using ArcGIS®.

Major 19th century port: The variable is a dummy which takes a value of 1 if the district in question lies within 20 km to any of the following major ports of the 19th century: The ports of Constantinople (Istanbul), Izmir (Smyrna), Samsun, Trabzon, Mersin, Iskenderun (Alexandretta). Otherwise the variable is coded 0. The spatial computations are made using ArcGIS®software.

In central kaza/sancak: A dummy which takes a value of 1 if the district in question is matched to either the central kaza (the central Ottoman district) of a sancak or the central sancak of a vilayet (Ottoman province) –the latter applies only for those vilayets which only have sancak subdivisions. The variable captures the location of historical economic centers and more urbanized places.

Log distance to war front (1919-1922): Logarithm of distance to the nearest war front during the Turkish War of Independence that took place during the period 1919-1922. The spatial computations are made using ArcGIS®software.

Log WW1 soldier casualty: Logarithm of total number of soldiers in the Ottoman Army who died in a battle during the First World War and whose birth province contains the district in question. The casualty data is retrieved from the List of Martyrs provided by the Turkish Ministry of National Defense.

Immigrants who arrived and were settled during 1921-1929 (1/1000): The predicted number of immigrants that were settled in Turkey during 1921-1929 period by district. Original data is available at the province level. We use 1927 shares of district populations in total province population to divide province level figures into individual districts in proportion to these shares. *Source:* Turkish Statistical Yearbook, 1930, Vol. 3.

Distance to Istanbul: The logarithm of distance of a district (in kilometers) to Istanbul. The spatial computations are made using ArcGIS®software. The shapefile is downloaded from DIVA-GIS in vector format. The primary source is the GADM database of Global Administrative Areas (version 1.0). The spatial computations are made using ArcGIS®software.

Distance to nearest national border: The logarithm of distance of a district (in kilometers) to the nearest modern border of Turkey with any its neighbors. The spatial computations are made using ArcGIS®software. The shapefile is downloaded from DIVA-GIS in vector format. The primary source is the GADM database of Global Administrative Areas (version 1.0). The spatial computations are made using ArcGIS®software.