Ethnic Capital and Sub-national Development: Armenian and Greek Legacy in Post-expulsion Turkey*

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March 2018

Abstract

Does historical exposure to highly-skilled populations lead to path-dependence in regional development? To answer this question, we study the long-term economic legacy of Armenians and Greeks of the Ottoman Empire using their mass expulsions from Anatolia as a unique natural experiment of history. Since these consecutive events led to an almost complete and permanent removal of both communities from Turkey within a short time period, our analysis can rule out any contemporaneous minority influence on development. Our empirical analysis on the sample of Turkish districts suggests that historical Armenian and Greek presence had a positive effect on contemporary population density, urbanization, and economic activity –proxied by nighttime lights. We also exploit within-district variation in nighttime lights across more than 49,000 villages and neighborhoods to document a highly localized minority influence. Those localities in close proximity to Armenian and Greek community buildings are more prosperous today than their otherwise similar counterparts. We argue that the long co-existence of Armenians and Greeks with Muslim populations was important for the persistence of minority legacy, and provide empirical evidence that this legacy was largely driven by minority contribution to local human capital accumulation.

Keywords: Human Capital; Economic Development; Expulsion; Minorities; Ethnicity; Armenians; Greeks; Persistence.

JEL classification codes: J15, O10, O15, O53, N35, Z12.

*We thank the participants at Brown University, University of Copenhagen, Copenhagen Business School, Freie Universität Berlin, Toulouse School of Economics, Stockholm Institute of Transition Economics, University of Gothenburg, Lund University, IMT Lucca, New Economic School, NRU Higher School of Economics, NBER Meeting, the Econometric Society Meeting, 2017 Economic History Society Meeting, European Economic Association Meeting, CEPR NYU-AD Workshop, CESifo Political Economy Workshop, ASREC, Workshop on Migration and Conflict at UC Louvain, CDED Workshop at University of Groningen, 6th Annual Workshop on Growth, History and Development, Workshop on Institutions, Individual Behavior and Economic Outcomes, Armenian Economic Association, and the Nordic Conference in Development Economics for valuable comments.

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1 Introduction

"His master taught geometry to my grandfather. He taught him mathematics. He was a craftsman who had a compass, a ruler, a miter, and a protractor in those times. Grandfather only knew how to read and write, but his Armenian master taught him. He used to stop my grandfather Ali while he was cutting wood: 'Ali, my son, did you measure, did you draw it well, did you make a model, a small plan of it on paper?' "

Kamil on his grandfather, in Neyzi and Kharatyan-Araqelyan (2010)

A large body of work on long-term persistence has documented the long-lasting legacy of geography, early institutional structures, cultural traits and historical events on socio-economic outcomes today. One particular strand of the literature attempts to separate the role of geography from that of ancestral legacy (Putterman and Weil, 2010; Easterly and Levine, 2012; Comin et al., 2010). Evidence suggests that locational fundamentals are important, but in many settings, ancestral origins of residing populations are even more influential predictors of contemporary development (Spolaore and Wacziarg, 2013). Existing studies mostly focus on how continuous presence of particular groups shaped the regions they settled (e.g. European settlers in the Americas) since the time of arrival until today. What is less understood is whether the legacy of indigenous populations continue to shape regional development even in their absence. In particular, we know little about the indirect influence of highly productive groups long after they leave their homelands en masse.

To address this question, we study the economic footprints of Ottoman Armenians and Greeks almost a century after their wholesale removal from their homelands in the territory of modern Turkey. These two indigenous communities of Anatolia possessed high levels of human capital and wealth, and were highly represented in modern economic sectors (Üngör and Polatel, 2011; Kuran, 2004a; Der Matossian, 2007; Kévorkian, 2011). Armenians were subjected to mass killings and deportations (also known as the Armenian Genocide) during the First World War, while the Greeks were forced out of Asia Minor following the Greco-Turkish War of 1919-1922 and the subsequent population exchange between Greece and Turkey in 1923. These events marked the end of centuries-long coexistence of the Muslim majority with the two biggest non-Muslim communities of the Empire. This episode provides us with two unique experiments of history well suited to empirically assess the long-run legacy of productive minorities on regional development, in general, and on local human capital, in particular. Our aim in this paper is not to isolate the economic effects of the expulsions, but to evaluate the long-term minority contribution net of the potential impact of these shocks.

While losing high-skilled groups is arguably harmful for regional development, whether regions with prolonged exposure to these groups would maintain their economic lead long after the expulsions is not a trivial question. The answer depends on a combination of factors. One factor is the nature of minority contribution to regional development prior to expulsions, i.e. the initial conditions. Second, economic forces of the post-expulsion period may amplify or erode the importance of these initial conditions over time. For instance, group interactions and the strength of human capital spillovers between minorities and the rest of the local population may contribute to persistence. At the same time, the expulsion, as an adverse shock to human capital and the social structure, may unleash social and

economic forces that work in the opposite direction (Acemoglu et al., 2011). For example, high-skilled minority presence might operate as a natural barrier to entry for the rest of the population and lead to occupational segregation (Spitzer, 2015a). This in turn may discourage investment in human capital by the low-skilled majority. Such a crowding-out effect might leave high-minority regions in a disadvantaged position in the post-expulsion period after minority human capital is permanently lost. Consequently, whether a positive minority legacy can sometimes dominate these negative forces in the long-run is an empirical question that, so far, has not been rigorously addressed.

Heterogeneity in the timing of outmigration, possibility of return migration and the potential endogeneity of these decisions to economic conditions pose serious challenges for measuring the legacy of a minority group. Our historical setting is largely immune to these problems. Both Greeks and Armenians were forced to leave their homelands in Anatolia as a result of the official state policies that were motivated partly by the ongoing wars and partly by the ideological orientations of the ruling elite. The mass expulsions of Armenians and Greeks led to an almost complete removal of these communities over a short time period. Around 1893, Armenians and Greeks, respectively, constituted about eight and ten percent of the Ottoman population in the territories that roughly correspond to Turkey today (Karpat, 1985). By 1927, however, 99 percent of Turkey's population (excluding Istanbul) was registered as Muslim. Since the expulsions occurred more than 80 years ago, we have a reasonably long time window to talk about persistence of minority legacy. With the exception of Istanbul, none of the provinces in modern-day Turkey was spared from the expulsions. Therefore we omit Istanbul from our sample and exploit sub-national variation in Armenian and Greek population shares in the late Ottoman period as a proxy for *historical exposure* of each region to minority presence without having to worry about contemporary spillovers across regions.

In the first part of the paper, we show that districts with higher historical Armenian and Greek presence are more developed today despite the plausibly negative effect of the expulsions. To evaluate long-term minority legacy, we exploit novel data with district-level variations in population shares of Armenians and Greeks prior to their departure, and various proxies for historical and contemporary development in Turkey. Baseline results suggest that districts with greater Armenian and Greek concentration before the expulsions are today (i) more densely populated, (ii) more urbanized, and (iii) exhibit greater economic activity measured by the intensity of lights at night (i.e. luminosity).[1] Estimated magnitudes imply around 11 and 14 percent increase in income per capita in response to a move from the 10th to the 90th percentile of the Armenian and Greek population share distributions, respectively.

Through a battery of robustness checks we demonstrate that the relationships we establish very likely reflect the causal effect of minority legacy rather than selection bias. First, our baseline results are robust to the inclusion of potential geographic and climatic determinants of early economic activity that might also have influenced historical settlement patterns. We also check the sensitivity of our estimates to various potential drivers of historical and contemporary development. For example, we find that minority presence exerts a sizable influence on regional development independently of (i) historical market access (e.g. proximity to historical railroads, trade routes or major ports), (ii) Muslim immigrants from Greece who came to Turkey as part of the population exchange, (iii) exposure to war during the expulsions

[1] Light intensity at night, or luminosity, is a widely used proxy for economic activity when more direct indicators of development are not available at the local level.

and (iv) density of neolithic settlements as a proxy for prehistoric conditions that were favorable to agriculture and amenable to permanent settlement. To account for selection on the aforementioned observable characteristics in a more flexible way, we also use various matching type estimators where we employ binary outcome variables for high minority presence. Our results are qualitatively similar to our OLS analysis.

Then, we zoom in to the level of villages and neighborhoods in Turkey to offer micro-level evidence on the persistence of minority legacy to this day. We find that nighttime light density is remarkably higher around those localities that are in close proximity to Armenian and Greek community buildings even after accounting for historical and contemporary confounders. Our estimates remain significant and sizable in the presence of fixed effects at the level of provinces, districts or sub-districts. These specifications exploit variations across localities that are very close to each other and thus highly similar in unobserved characteristics.

We explore various channels through which minority legacy might have persisted. First, we focus on what we broadly term as the human capital channel. We provide historical evidence that Ottoman Armenians and Greeks were on average more educated than their Muslim counterparts and constituted a disproportionately high share of the skilled labor force. Moreover, Muslims who lived in regions with high minority concentration were relatively more educated than other Muslim populations. Consistent with the human capital channel, we show that, even in the immediate aftermath of the mass expulsions, regions that were previously home to Armenians and Greeks still had higher literacy rates than low-minority regions, reflecting the relative literacy rates of remaining Muslim populations. Importantly, we demonstrate that today there are still significant gaps in educational attainment between high and low-minority districts. Our baseline estimates suggest that a move in either historical Armenian or Greek share from zero to 20 percent implies an increase in current high school completion rates by about 2.1 percentage points. This change amounts to more than 12.5 percent of the mean completion rate (16 percent). However, this effect of historical minority presence diminishes significantly once more direct proxies for exposure to minority human capital such as the proximity to minority school buildings or historical literacy rates among the Muslim population are accounted for. We also show that proximity to old minority school buildings predicts higher luminosity above and beyond the influence of other types of community buildings.

As an additional channel of persistence, we then assess the potential role of productive minority assets, and the way they were redistributed among the Muslim population in the aftermath of the expulsions. We first argue that in regions where redistribution of confiscated minority assets among Muslim groups was highly unequal, we should observe greater wealth concentration in the long run. Then we offer suggestive evidence consistent with this hypothesis. We show that, conditional on geography and minority population shares, contemporary land inequality is positively related to the presence of community buildings built by Armenians. This finding is in line with the anecdotal evidence that the main beneficiaries from the "abandoned" Armenian property were members of local Muslim elite rather than small immigrant groups who settled after the expulsions. Historically Greek areas, on the other hand, received larger flows of Muslim immigrants, and Greek property was relatively less subject to asset grabbing by local elite than Armenian property. Accordingly, we find that modern land inequality is not related to historical Greek buildings. Finally, we assess the legacy of minority assets on long-term

development. Although we do not find much evidence to suggest a direct legacy of physical minority assets, our regression results are consistent with a more indirect effect of Armenian –but not Greek– assets. We cannot rule out the possibility that redistribution of confiscated Armenian property was accompanied by higher wealth concentration –proxied by land inequality– which in turn relaxed constraints on financing new enterprises and gave a head start to ex-minority regions.

We interpret the reduced-form effects of Greek and Armenian presence as a positive legacy of high-skilled minorities. Alternative explanations such as the reduction in religious diversity or historical selection in settlement patterns either do not square with the historical evidence or fail to explain away our findings. Anecdotal evidence at the regional level and the income statistics at the aggregate level support the common view that removal of Armenians and Greeks from Anatolia has reduced productivity in the short-run vis-a-vis the pre-expulsion period (Pamuk, 2007). Furthermore, historical trends in population density reveal that after the negative effect of expulsions subsided, the gap between high- and low-minority regions widened over the longer term.[2] These trends cannot be easily reconciled with a positive and persistent effect of reduced religious diversity for two reasons. One is the fact that historically more homogeneous regions did not have higher population density prior to expulsions. The second reason is that these regions also experienced slower population growth than high-minority areas in the post-expulsion period. Instead, these population dynamics are consistent with the view that long-term presence of Armenians and Greeks shaped the economic fundamentals of these regions –most importantly human capital– in a positive and enduring way. It is possible that these economic fundamentals resulted in agglomeration effects which became even more decisive during the process of Turkish industrialization, facilitating the formation of new businesses and the inflow of skilled labor. Our interpretation of the persistent minority legacy is consistent with path-dependence in regional development whereby Armenians and Greeks gave their home regions a historical head start that was self-reinforcing.

The next section places the paper in the literature. Section 3 provides information about the economic position and the legal status of Greeks and Armenians in the Ottoman Empire, and offers a brief historical summary of the events leading up to the expulsions. Section 4 describes the data. Section 5 presents district level evidence, while Section 6 presents evidence at the village/neighborhood level. Section 7 explores potential channels of persistence. Section 8 concludes.

2 Related Literature

This paper primarily contributes to the broad literature on the importance of human capital in development and more specifically on the economic contribution of highly-skilled ethno-religious groups to the locations they settled. Some papers have sought to explain how these groups came to differ from the rest of the society with respect to their educational attainment, occupational choice and settlement patterns (Botticini and Eckstein, 2007, 2012b; Spitzer, 2015a). Some others have studied how these groups affected the socioeconomic and political landscape of the regions they lived in (Becker and Woessmann, 2009; Hornung, 2014; Acemoglu et al., 2011; Moser et al., 2014; Pascali, 2016; Johnson and Koyama, 2016).[3] Our first contribution to this literature is to establish the *persistent historical legacy* of high-

[2] We describe these trends in Section 3 when we provide some historical background.

[3] Some prominent qualitative work on the subject are Weber et al. (1930); Weber (1968); Sombart (1951); Braudel (1982).

skilled groups rather than the effect of their *continuous presence* on modern development. Second, we argue that this legacy largely reflects these groups' influence on local human capital accumulation among Muslims.[4] Third, our study focuses on Greeks and Armenians of the Ottoman Empire who have so far received very little attention in empirical work on minorities.[5]

Our paper also speaks to the well-known debate about Islam and underdevelopment by documenting the long-lasting influence of two major Christian communities of an Islamic empire. To our knowledge, this paper constitutes the first systematic subnational study that reveals, albeit indirectly, the prosperity gap between non-Muslim and Muslim groups of the Near East.

Our paper also relates to studies investigating the consequences of expulsions. For example, Waldinger (2012) studies the expulsion of Jewish academics from German universities as a negative shock to human capital spillovers within the academia. Chaney and Hornbeck (2015) study the effect of the expulsion of Moriscos from the Kingdom of Valencia in 1609 on Malthusian convergence dynamics. Acemoglu et al. (2011) show how the persecution of Jews by the Nazis in the WWII left a persistent negative impact on the social fabric and education of Russian cities. In contrast, we argue that although expulsions of Armenians and Greeks might have had negative effects on productivity in the short-run, their centuries-long presence and co-existence with Muslim groups have transformed the development potential in these regions.

In a related paper, Maloney and Valencia Caicedo (2016) documents within country persistence of economic activity in the New World and evaluates the contribution of locational fundamentals and classic agglomeration forces to this process. Our paper demonstrates that the legacy effect of high-skilled groups can be an important source of such subnational persistence. In the context of long-term persistence of group legacy, our work is closely related to Grosfeld et al. (2013) who focus on the Pale of Settlement where Jews were allowed to live in the Russian Empire. They show that current residents of the Pale of Settlement exhibit higher anti-market attitudes, lower entrepreneurship and higher within-group trust. The authors argue that the negative legacy of the *forced* co-existence of Jewish and Christian groups was partly a byproduct of the anti-Jewish culture. In contrast, we find a positive legacy of *unforced* co-existence of Greek and Armenian communities with their Muslim neighbors. However, these seemingly disparate findings are due to the distinct historical settings of the two papers. For centuries, the Ottoman Empire ruled over a vast, ethno-religiously diverse territory. For most part of their common history, different communities lived together in relative peace. The state accepted and affirmed differences between non-Muslims and Muslims instead of attempting to homogenize the society (Rodrigue and Reynolds, 1995), and this allowed greater autonomy for them to flourish.[6] In the case of the Jewish communities in Europe, the social and institutional environment was arguably less conducive to peaceful interaction

[4] In a similar vein, Caicedo (2015) documents the positive and persistent legacy of Jesuit missions on educational attainment among native populations of modern-day Argentina, Brazil, and Paraguay. Our paper, on the other hand, focuses on the legacy effect of native groups on local human capital accumulation instead of the long-term effects of a explicit human capital intervention.

[5] Sakalli (2017) is an exception which documents a different aspect of Armenian legacy on modern Turkey and finds that the level of religiosity is higher in those areas of Eastern Turkey where historical co-existence between Muslims and Armenians was more intense. Among the other few exceptions analyzing legacy of non-Muslim communities of the Ottoman Empire, Grosjean (2011) shows that locations in South Eastern Europe which had greater non-Muslim presence have relatively higher bank penetration today.

[6] "*Millet* system" of the Ottoman Empire was instrumental for the emergence of a sociopolitical order which allowed each of the major non-Muslim religious communities a certain degree of legal and cultural autonomy. We elaborate on the Ottoman system and institutions of coexistence in Section 3 when we discuss the historical background.

and positive spillovers. Social and occupational segregation between Jews and Christians was high, and ethnic animosity towards Jews was widespread (Spitzer, 2015a). Yet, as Johnson and Koyama (2016) show, in cities where peaceful co-existence was achieved (e.g. due to religious tolerance), Jewish presence facilitated urban development in pre-industrial Europe.[7]

This paper also speaks to the literature on historical path dependence, such as the consequences of the Black Death in Europe in the 1340s (Postan, 1973; North and Thomas, 1973; Brenner, 1976; Jedwab et al., 2016), the 1840s Irish famine (O'Rourke, 1994; Whelan, 1999; O Grada, 2000), wars (Davis and Weinstein, 2002; Miguel and Roland, 2011), slave trade in sub-Saharan Africa (Law, 1991; Lovejoy, 2000; Nunn, 2008), and pre-colonial ethnic institutions in Africa (Michalopoulos and Papaioannou, 2013a). Our work differs from these papers by studying a different source of path-dependence, namely the historical exposure of a location to highly-skilled ethnoreligious groups.

Lastly, this paper contributes to the literature on regional development in Turkey as it is the first one to document the positive legacy of the Armenian and Greek populations of Anatolia on a large geographical scale, whereas previous work on the topic has been qualitative.[8]

3 Historical Background

3.1 Armenians and Greeks in Anatolia prior to the Ottoman Rule

Majority of Ottoman Armenians lived for centuries in the western half of their historic homeland, also called the Armenian Plateau, that coincides with the eastern part of modern Turkey. Armenian tribes and language dominated the region as early as the middle of the 1st millenium BC. Official chronicles circa 6th century BC refer to the Armenian Plateau as 'Armenia' (Khachikyan, 2010). From the first unified Armenian state of Van Kingdom (860 BC - 590 BC) –the Kingdom of Urartu– to the Armenian Kingdom of Cilicia (1080-1375), a series of Armenian states ruled over the Armenian Highlands and its peripheries. Armenians are one of the most ancient Christian communities and the Kingdom of Armenia was the first state to adopt Christianity (in 301 AD) as the official religion. Following the adoption of Christianity, first religious schools were established. Then, throughout history, Armenian society ascribed an important role to education.[9] By the 10th century, almost all Armenian cities and many rural population centers had elementary schools. Many students were sent abroad to study in prestigious schools of the time. As early as the 9th century, Armenians established institutions of higher education (*Vardapetarans*). From 13th century on, some *Vardapetarans* transformed into universities, and contributed to the growth of science and culture in Armenia (Khachikyan, 2010).

Just like Armenians, Greeks inhabited Anatolia for centuries before Turkish arrival. Greeks were settled predominantly in central and western Anatolia in the Eastern Mediterranean. First Greek colonies (city-states) in Asia Minor were established in the 13th century BC (Burckhardt, 1998). Byzantine Empire was the primary home to Greeks until the conquest of Constantinople by the Ottomans in the 15th century.[10] Christianity became state religion in the 4th century. After the 7th century, Byzantine

[7] Jha (2013) also shows that complementarities between Hindus and Muslims in India led to a legacy of ethnic tolerance.

[8] See Altuğ et al. (2008); İçduygu (2009); Mutlu (2002); Pamuk (1987); Toprak (2012).

[9] Armenian alphabet was developed around 405 AD by Mesrop Mashtots. First complete Armenian book and one of the first medical books date back to the 9th and the 13th centuries, respectively.

[10] See Figure C.1 in the Online Appendix for maps that describe the historical homelands of Armenians and Greeks.

Empire became increasingly influenced by Greek culture so much so that Greek replaced Latin as the Empire's official language (Haldon, 1990; Haywood, 2001). By the standards of the time, Byzantine society was highly literate,[11] literacy rates among Byzantine Greeks were higher than in the West, and access to elementary education and book ownership were widespread (Browning, 1989).

The first Islamic incursions into the region began in the mid-7th century when the Arab Caliphate captured the near eastern provinces of Byzantium. As a result, part of the Armenian population in the region was driven out of fertile lands into the mountainous areas. In the 11th century, nomadic Turkic tribes began to penetrate into Asia Minor through eastward expansion of the Great Seljuk Empire. Following Seljuk Turks' victory under Alp Arslan against the Byzantine army in the Battle of Manzikert (1071), Alp Arslan authorized numerous Turkmen beys to carve their own principalities out of formerly Byzantine Anatolia. These beyliks rapidly established control of the region as far as the Aegean Sea. Following the disintegration of Seljuk Sultanate of Rum, the Ottoman Beylik, a Turkish principality in northwestern Anatolia, managed to conquer remaining Byzantine territories in Anatolia and extend its control over the Balkans during the 14th century. The dominance of Islam in Anatolia was sealed by the Ottoman conquest of Constantinople in 1453.

3.2 Armenians and Greeks under the Ottoman Rule

From its foundation in 1299 until its dissolution in 1922, the Ottoman Empire stretched across Asia Minor, the Balkans, Maghreb and the Arabic peninsula, and ruled over ethnically and religiously heterogeneous peoples. Ottoman treatment of non-Muslims was mainly guided by imperial needs and practical concerns (Braude, 2014). Although state religion of the Ottoman Empire was Islam, it was tolerant towards other religions for most part of its existence. In addition to religious freedom, non-Muslims also had considerable autonomy in the spheres of organization of education, and the laws of marriage, divorce and inheritance. Forced conversion to Islam was against the Sharia law, and non-Muslims were free in their choice of residence and profession.[12] As the Empire incorporated a greater number of diverse peoples, it became necessary to institutionalize various groups into the empire. After the conquest of Constantinople, Sultan Mehmet II laid the foundations of the *millet* (religious community or nation) system. This 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 degree of autonomy in their internal affairs pertaining to religious and cultural practices, education, fiscal matters and civil law. In particular, each ethnoreligious group was organized into a separate *millet* with the right to elect its own religious leader and to establish its own courts to oversee legal disputes between members of the same community.[13] Non-Muslims paid a poll-tax (*jizya*) and a levy on land holdings (*kharaj*) in exchange for their status as *reayas* ('protected flock' of the sultan). This status meant that the state was to ensure their personal safety and the security of their property. Due to the key role of non-Muslims in the Ottoman economy and their contribution to tax revenues, the state-minority relations could be best described as mutual –rather than one-sided– dependence.

[11] Byzantine society around the 13th century had "a completely literate church, an almost completely literate aristocracy, some literate horsemen, rare literate peasants, and almost completely illiterate women" (Oikonomidês and Langdon, 1993).

[12] One exception of involuntary conversion to Islam was the *devshirme* system introduced in the 14th century. It entailed drafting Christian boys, who were converted to Islam and trained to serve in the military or administration (Braude, 2014).

[13] However, all judicial cases involving a Muslim party had to be overseen by the Islamic courts.

3.2.1 Muslims and non-Muslims in the Economic Sphere

19th century Ottoman economy was predominantly agrarian. Population growth in Anatolia was slow at 1% a year (Issawi, 1980, pp.11-12). Migration from rural to urban areas was weak, and urban population share rose from 17% in the 1830s to only 22% by 1912 (Issawi, 1980, pp.34-35). Agricultural production was the main tax base of the Ottoman state and tax collection was achieved through tax farming (*iltizam*). The state would auction the right to collect taxes in a given place for a certain period, and the winners (tax farmers) would pay the state in advance. Tax farmers would typically finance these purchases through loans from Jewish, Greek or Armenian bankers. In towns, craftsmen dominated manufacturing thanks to monopolies granted by the government in exchange for tax revenues and political support.

Historically, Armenians and Greeks of the Ottoman Empire were ahead of the Muslim population in their economic modernization. They were relatively more urbanized than Muslims, but even in rural areas there were notable differences in the types of cultivated crops (and their market return) and agricultural knowhow in favor of Armenian and Greek farmers. (İnalcık and Quataert, 1994; Kieser, 2001). Non-Muslims' control over skill-intensive modern occupations was not so significant before the 18th century. Greek and Armenian economic ascent began in the late 18th century,[14], and by the 19th century non-Muslim minorities of the Empire had a disproportionate control over trade, commerce and finance (Kuran, 2004a). They were engaged in higher value-added sectors in trade, agriculture and manufacturing, and owned greater wealth relative to Muslims (Kuran, 2004a; Der Matossian, 2007; Kévorkian, 2011). For example, Armenian merchants dominated regional trade with Iran and India (Eldem, 2006). In the Black Sea region, Armenian and Greek merchants dominated the brokerage between Western and local traders. By the end of the 19th century, in the province of Trabzon, out of 33 exporters, 29 were Greek or Armenian (Kuran, 2004a).[15] Along the Aegean coast, Greeks dominated commerce constituting 40 to 60% of the merchants, while their population share was 20 to 38% (Kuran, 2004a).[16] Similarly, in Istanbul, a predominantly Turkish city, Turks made up just 4% of export-import merchants by 1914. Official statistics also confirm these numbers. According to the Ottoman yearbook of 1912, Muslims of the empire, 81% of the total population, not only had no role in trade with Europe, but also had only a limited role in local trade. They made up 15% of local traders, while Armenians and Greeks made up 23 and 43% of local traders, respectively (Sonyel, 1993).

In the 19th century, westernization and modernization provided a great impetus for Ottoman trade and industry. However, not all regions of Anatolia benefited equally from these improvements. Regions with historically high Armenian and Greek presence enjoyed considerable advantage. For example, the province of Maras thrived in the 19th century mostly owing to the presence of Armenian master-craftsmen and merchants despite its relative isolation from main trading routes (Keshishian, 2011). Production and commerce in the villages were almost fully controlled by Armenians, and the newly-created financial upper

[14] For example, records from the 16th century Turkey indicate that while Christians had significant control in some sectors of trade and commerce, Muslims were dominant in others (Lapidus, 1967; İnalcik, 1960). Also, until this period, minorities did not dominate financial markets, and *cash waqfs* (non-intermediating credit suppliers) were largely controlled by Muslims.

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

[16] A large majority of Ottoman traders and shippers were Greeks from the Aegean coast and islands. Their growing commercial interests since the late 18th century led them to create an international network in major trading centres outside the empire, such as Marseilles, Trieste and the recently founded Russian port city of Odessa on the Black Sea.

class in the city consisted exclusively of Armenians.[17] This financial upper class developed contacts with progressive towns, quickly adopted the latest European customs and manners, and introduced them to Maras. They also imported the latest trading methods into their home towns. Being aware of the importance of education as a key for success in modern economic sectors, they not only directed their own children towards education, but also laid the ground for educational work in Maras by founding schools.

Beyond anecdotal evidence, descriptive evidence on the role of minorities in the Ottoman economy as of 1894/1895[18] suggests that the average income per capita among the Ottoman provinces with above median minority share was larger than those with below median minority share, 123.6 *kurus* versus 111.5 *kurus*.[19] Given that the Ottoman economy was still largely Malthusian at the time, the difference in income per capita understates the actual productivity gap. In contrast, population density is a more relevant proxy for productivity. The top panel in Figure 1 shows that average population density in provinces with above median minority share was almost twice as high in 1893 as those with below median minority share. Importantly, this gap grew even larger by 1906. High minority provinces not only had larger population density at the end of the 19th century, but they also experienced faster growth on average compared to low minority provinces. The bottom panel in Figure 1 provides further evidence on the positive and statistically significant association –conditional on year fixed effects– between population density and minority share between 1893-1906 at the level of Ottoman provinces.

Scholars suggest various explanations for minorities' economic success. For one, Muslims eschewed finance and commerce, whereas Christians did not. Another explanation is that Westerners favored Christians of the Ottoman Empire, and in turn, these business networks proved increasingly lucrative as modern capitalism gained pace. Kuran (2004a) 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, settling disputes in Western courts, and benefiting from tax concessions offered to non-Muslims under Western protection, whereas Muslims could not benefit from such modern institutions.[20] Moreover, Islamic inheritance law was more egalitarian than its Western counterparts, which limited wealth concentration for Muslims and stifled capital accumulation.[21] Moreover, Islamic courts were openly biased in favor of Muslims, and this implied that Muslims on average were less trustworthy as borrowers, and thus, faced higher borrowing costs (Kuran and Rubin, 2017). Occupational specialization patterns also contributed to and were reinforced by the differences in educational attainment, as suggested by Botticini and Eckstein (2005, 2007) for the case of Jews.

Educational attainment of Muslims also fell over the centuries due to the rigidity of waqf-based education institutions (Kuran, 2004b). Across Ottoman provinces in 1894/95, the average proportion of

[17] In contrast to Armenians, very few of the local Islamic upper class were merchants or artisans. Most of them were either landowners or government officials. The villagers, on the other hand, were mostly employed in farming.

[18] Based on information for 27 Ottoman provinces reported by Karpat (1985).

[19] Also, the 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. For example, in Istanbul in 1885, Greek and Armenian population shares were 22 and 20 percent, respectively, while their shares in employment in commerce and industry were 36 and 43 percent, respectively (Karpat, 1985).

[20] In the 18th and especially over the 19th centuries, a greater number of local Christians sought to acquire decrees of appointment (*berat*) to benefit from the privileges that capitulations (political and economic concessions granted by the sultan) offered to the Christian foreigners (Zurcher, 2004, p.11).

[21] Kuran and Lustig (2012) and Kuran (2012) discuss the Islamic legal tradition and its implications for minorities.

primary school students within non-Muslim population of Greeks and Armenians combined was about 1.6 times as high as that of the Muslim community (see Figure C.2 in the Online Appendix).

3.3 Expulsions and the Process of Ethno-religious Homogenization

In the second half of the 19th century, European powers increasingly pressured the Empire to improve the rights of Christian minorities. After the Russo-Ottoman War of 1877-78, the Treaty of Berlin between the Ottoman Empire and the Western powers brought concerns about the treatment of Ottoman Armenians and their future in the Empire –the Armenian Question– onto the international stage. However, the Berlin Treaty failed to provide a viable solution to the Armenian Question. Rising nationalism and demands among Armenians, the lobbying efforts of Armenian Committees at the international arena further fueled the government's distrust of Armenians. At the same time, concerns about the fate of the empire and discontent about Sultan Abdulhamid's rule were growing among Turkish civilian and military bureaucracy. A strong opposition group, the Young Turk Committee of Union and Progress (CUP), seized power through a coup in 1908. Although CUP initially appeared reform-oriented to unify all *millets* under an overarching Ottoman identity, it quickly set on a national homogenization path. Dominant view within CUP prioritized Turkish ethnicity and the creation of a homeland with a Muslim majority (Zürcher, 2003). With the outbreak of the WWI, the CUP government consolidated dictatorial powers. Using their concerns about Armenian support to Russian troops in the Russo-Ottoman war and popular armed resistance as a justification, in 1915 CUP embarked on a wholesale anti-Armenian extermination policy. In April 1915, religious leaders of the Armenian community and intellectuals were arrested. Although the implementation of secret deportation orders was already underway in many of the Ottoman provinces, expulsions were officially authorized on May 27, when CUP leaders issued the "Temporary Law of Deportation " (*'Tehcir Law'*). Consequently, Armenian populations of Anatolia as well as European Turkey (with the exception of the Ottoman capital, Istanbul) were removed through massacres and death marches to the camps in Syria (Kévorkian, 2011; Akçam, 2012; Dündar, 2008). By the end of the WWI, which also marked the end of the reign of CUP, more than one million Armenians were removed from their homes. Most of them died during forced marches either due to starvation or through direct killing. Those who were able to escape the massacres and survived the deportations took refuge in neighboring countries or migrated to Europe or the US. The way deportation orders were carried out and the relative roles played by the local governments, the army and the paramilitary wing of the Central Committee of the CUP (*Teşkilat-ı Mahsusa*) during the process varied by region (Kévorkian, 2011). Yet, the eventual results of the liquidation campaigns were the same in all affected regions. From the Vilayet of Erzurum at the eastern end of the Empire to the Vilayet of Edirne spanning the European part of Turkey, Armenian communities virtually disappeared either due to expulsions or the subsequent outmigrations of a remaining few.

Although Greeks also suffered from harassment and massacres during CUP's reign, the first wave of involuntary mass emigration of Greeks took place towards the end of the Turkish War of Independence in 1922. As the Greek army retreated, many Greeks from Western Asia Minor fled to the Greek mainland (Zürcher, 2003). Remaining Greek communities of the Empire were expelled en masse –including those outside war zones– only in 1923, as a result of the Convention Concerning the Exchange of Greek and Turkish Populations at the Lausanne Conference. The convention stipulated an

exchange of the Muslim populations in Greece for the Orthodox Greek populations in Turkey.[22] The Muslims of Western Thrace and the Greek Orthodox residing in Istanbul were the only two groups exempted from the population exchange. The population swap was the result of a mutual agreement between the Greek and Turkish governments, and it was accomplished very quickly mainly because it suited the interests of both governments. After the war, neither government wanted to run a country with a large religious minority. The involuntary exodus involved around 1.3 million Orthodox Greeks. In exchange, around 354,000 predominantly Turkish Muslims who were expelled from Greece resettled in Turkey (Hirschon, 2003). In a matter of few years, the population exchange program achieved its goal of religious homogenization on both sides of the Aegean Sea. The Orthodox Greek community of Turkey diminished to irrelevantly minuscule numbers in their original locations (Friedman, 2006).

Both the Armenian Genocide and the Greek expulsions of 1922-1923 can be viewed as part of a de-Christianization process. This process dramatically altered the demographics of Turkey and stripped it from its Armenian and Greek communities. In 1893, Armenian and Greek shares in the total population were about 8% and 10%, respectively. However, by 1927, more than 99% of Turkey –excluding Istanbul– registered Muslim.

4 Data

4.1 District Level Data

Historical Armenian and Greek Populations. 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).[23] This census is the first Ottoman Census where not only male, but also female population of the Empire was counted. Unlike the Muslim groups, who are lumped into one big category, the census classifies the non-Muslim population into various groups by nationality, ethnicity or religion, including Greeks and Armenians.[24] 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.[25]

Unit of observation is a modern Turkish district (*ilçe*). We assign each modern Turkish district to an Ottoman district using the mapping between Ottoman location names and contemporary locations

[22] Formally speaking, inclusion to the population exchange was decided not on the basis of ethnicity or language, but on the basis of religious affiliation. Therefore, Turkish-speaking Orthodox Greeks in Turkey as well as Greek-speaking Muslims in Greece were also part of the swap.

[23] Karpat (1985) argues that the official Ottoman Census records should be deemed as the most reliable source of information about the Ottoman population. These censuses were primarily designed to meet administrative and military needs, especially the need to acquire accurate information about the number and the age of the male population for the purposes of recruitment into a modern army.

[24] The population figures are reported at the level of Ottoman *kazas* (district), which is the third level administrative division after *vilayet* (province) and *sancak* (akin to county).

[25] In some Ottoman regions census counts were incomplete due to the difficulty of counting nomadic tribes. Therefore, in our main analysis we leave out those modern districts that were mapped to these Ottoman locations, but demonstrate in the Online Appendix that our results are robust to including these districts while imputing admittedly unreliable population estimates. Using rough estimates of uncounted people and making some arbitrary assumptions about their cross-district distribution one can construct estimated minority shares for these modern districts. See the Data Appendix for details about construction of this variable. In addition, data for the areas that were under Russian occupation at the time of the census are not available.

available in Sezen (2006).[26] Figure B.2 in the Data Appendix presents the resulting spatial distribution of the Armenian and Greek populations in Ottoman Turkey as projected on the modern Turkish districts. The cross-regional variation in minority shares demonstrates the distinct patterns of settlement of the two groups. Armenians were heavily concentrated in their historic homelands in the eastern half of Anatolia, while Greeks were more concentrated in the coastal regions in the west, the Thrace region in northwest Turkey and eastern part of the Black Sea coast.

Outcome Measures. The first set of long-run outcome measures are the population density and the urbanization rates at the district level from the Turkish census of 2000. 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.[27]

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 province level. In contrast, using satellite light density at night (luminosity) as a proxy for local economic activity, we are able to exploit variation across more than 700 districts.[28] Averaging across pixels that fall within district boundaries, we construct a measure of average light density in 2000 at the district level.[29] Figure B.1 in the Data Appendix depicts the cross-district distribution of average luminosity along with the historical representation of Armenians and Greeks in the Ottoman population.

Controls. To account for potential exogenous drivers of early Armenian and Greek settlements in economically more viable areas, we construct several measures of geographic and climatic attributes. These baseline control variables include latitude, longitude, adjacency to sea, lakes and major rivers, average elevation, standard deviation of elevation, average annual temperature and precipitation, and agricultural suitability.[30]

4.2 Village/Neighborhood Level Data

Given that we do not have minority figures at the village/neighborhood level from historical censuses, we proxy the long-run presence of minorities at the village/neighborhood level with historical minority

[26] See the Data Appendix for more details.

[27] In all regressions, we omit from the sample Istanbul province, the capital of the Ottoman Empire since 1453 and by far the most populous and developed province in modern Turkey. Unsurprisingly, including districts of Istanbul in the sample results in a noticeably larger positive correlation between historical minority presence and the indicators of development.

[28] The luminosity data are 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. 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.

[29] 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 (2013b), 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. Nevertheless, we make an internal assessment of our luminosity measure. Figure C.4 in the Online Appendix shows a strong positive correlation at the province level between GDP per capita and average luminosity in 2000, offering direct evidence that light density is a good proxy for local economic activity in the Turkish context. The R-squared of this bivariate relationship is around 33 percent.

[30] Table C.1 in the Online Appendix shows the summary statistics for all the variables we use in our district-level analysis including those that will be discussed in subsequent sections. Sample averages for Greek and Armenian shares are somewhat different from the overall shares of these groups in 1893 population for two reasons. First, our baseline sample excludes Istanbul and those provinces where census counts were incomplete. Second, since some modern districts are mapped to the same Ottoman district, they are assigned the same historical population share.

buildings within a given radius, and explore whether minority community buildings predicts luminosity in the vicinity of each locality. These data are from the Cultural Heritage Map of Turkey.[31] This gives us the most reliable sub-province level variation in minority presence. We use luminosity as our outcome measure also for the village/neighborhood level analysis.[32]

5 District Level Evidence

In this section, we assess the relationship between historical presence of Armenians and Greeks, and contemporary development outcomes at the district level. Key to our identification is the fact that systematic expulsions forced all Armenians and Greeks out of their homelands in modern-day Turkey with the only exception of Istanbul. The scope of these unfortunate events allows us to use pre-expulsion population shares of Armenians and Greeks as proxies for historical exposure of each district –other than those in Istanbul Province– to minority presence without having to worry about contemporaneous influence these groups might otherwise have had or cross-regional spillovers of such influence in the post-expulsion period. Our baseline specification is given by

$$y_i = \alpha \left(A_{1893}\right)_{k_i} + \gamma \left(G_{1893}\right)_{k_i} + \delta \ln \left(PD_{1927}\right)_i + \theta' \mathbf{X_i} + R_i + \varepsilon_i, \tag{1}$$

where y_i is an outcome of interest (e.g. light density in 2000) in modern district i. Variables of interest are the historical Armenian share, A_{1893}, and Greek share, G_{1893}, in the Ottoman kaza k to which district i was assigned. We include both Armenian and Greek shares simultaneously to account for any bias that would result if the two populations sorted into localities where the other group was more or less concentrated. Population density PD_{1927} in modern district i is included as a proxy for initial economic conditions.[33] Conditioning on historical population density is essential to make a meaningful comparison between post-expulsion changes in outcome measures across districts with different historical minority presence. It also allows us to partly account for historical selection bias. For example, there could be selective Muslim migration that is driven by post-expulsion population density in each district. $\mathbf{X_i}$ denotes the set of exogenous geographic and climatic factors that might influenced early Armenian and Greek settlements. R_i denotes fixed effects associated with the modern region/sub-region of district i. We cluster standard errors at the modern province level.

Our baseline analysis is based on OLS estimation, where the identifying assumption is that conditional on historical population density, region specific fixed effects, and geographic factors of historical development and economic activity of the time (i.e. agriculture), which might have driven minority

[31] This is the cultural heritage inventory project by Hrant Dink Foundation. The map records Armenian, Greek, Syriac, and Jewish cultural heritage in order to make visible the multiple cultures and facets of different communities in Anatolia. Information on public buildings such as churches, schools, monasteries, cemeteries, synagogues, and hospitals has been gathered from primary and secondary sources, as well as from various archives. See http://turkiyekulturvarliklari.hrantdink.org/en/.

[32] Table C.2 in the Online Appendix shows the summary statistics for all the variables we use in our village/neighborhood-level analysis.

[33] Since there are no well-defined boundaries of Ottoman districts, we are not able to compute precise population density for 1893. Therefore, we prefer to control for the population density in 1927, the first census of the Turkish Republic. However, when we alternatively use a rough proxy for population density in 1893 as a control for initial development our results remain unchanged.

settlement patterns millennia ago, remaining unexplained drivers of contemporary economic activity should not be correlated with historical minority presence.

5.1 Minorities, Population Density and Urbanization

Was there any meaningful relationship between minority concentration and the level of development already in the late 19th century? Although disaggregated historical income data are not available for Ottoman districts, to the extent the Ottoman economy was still governed by Malthusian dynamics back in 1893, population density should serve as a proxy for the level of development. Figure 2 presents the conditional and unconditional relationships between minority shares and population density in 1893 at the level of Ottoman districts (*kaza*).[34]

The unconditional negative relationship, shown in the top left panel, between historical Armenian shares and population density in 1893 simply reflects the fact that the areas where Armenians settled were historically less densely populated. The historical homeland of Ottoman Armenians was situated in the eastern half of Turkey with 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 development potential in Anatolia. 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 figure suggests, once we account for the geographic controls and the Ottoman province (vilayet) fixed effects, 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. They imply that, unlike Armenians, Greeks were concentrated in areas that were geographically more conducive to high density settlements with greater economic potential (as hinted in Figure B.2). Once we control for geographic attributes the relationship becomes weaker, yet remains significant. However, in the presence of province fixed effects, the positive relationship disappears.[35] Overall, these results are suggestive of historical settlement patterns that were on average negatively selected for Armenians and positively selected for Greeks.

How did regional distribution of population evolve in the aftermath of the expulsions? We first look at the short-term impact of expulsions on regional population density in 1927 (first census year after the expulsions). The top panel of Figure 3 shows the mechanical negative impact of deportations and the population exchange on population density, conditional on pre-expulsion population density, geographic controls and sub-region fixed effects.[36]

In the longer-run however, 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. Figure 4 compares the population dynamics in previously high-

[34] Population density measures are constructed using rough proxies, as *kaza* boundaries are not directly observable. Given the extent of measurement error, the results should be interpreted with caution.

[35] One should keep in mind that the impact of minority legacy on development may become more pronounced over time if the return to human and physical capital increases with further industrialization and integration with the global economy.

[36] See also Panel A of Table C.3 in the Online Appendix for the corresponding marginal effects and more details.

and low-minority districts in the post-expulsion period.[37] Population density of high-minority regions not only recovered after the expulsions, but it continued to grow faster on average than low-minority regions, leading to a divergence.[38] The trends in Figure 4 are consistent with our hypothesis that Armenians and Greeks had a persistent effect on the course of development during the post-expulsion period.

To check more rigorously if contemporary population density is indeed systematically higher in areas with greater historical minority presence, we regress population density in a modern district in 2000 on minority shares, conditional on population density in 1927, baseline controls and subregion fixed effects. Bottom panel of Figure 3 shows that districts with greater concentration of historical minorities are indeed more densely populated in 2000.[39] Thus, Figure 3 and Figure 4 together support the view that despite enduring more negative shocks to population, over the longer term, regions with greater minority presence nonetheless managed to overtake their ethno-religiously more homogeneous counterparts. Marginal effects of a move from-10th-to-90th percentile of minority shares are 23 and 21 percent increases in 2000 population density, for Armenians and Greeks respectively (see Panel B of Table C.3 in the Online Appendix).[40]

Next, we assess the long-run legacy of minorities on urbanization rates in 2000. Urbanization is arguably a better proxy for the degree of economic modernization than population density, and it highly correlates with income per capita.[41] Figure 5 shows that districts with higher historical exposure to minority presence are significantly more urbanized in 2000 even after controlling for the baseline geographic characteristics and subregion fixed effect.[42] A move from the 10th to the 90th percentile of the regional distribution of Armenian population shares is associated with a 9.2 percentage point increase in urbanization rate in 2000, significant at the 1 percent level. The same effect is 5 percentage points for Greek population shares.[43]

5.2 Historical Minority Presence and Nighttime Lights

5.2.1 Baseline Analysis of Minority Legacy

Our main proxy for economic development is the intensity of nighttime lights (luminosity). In light of previous results on contemporary population density and urbanization rates, we conjecture a positive

[37] We define a high-minority district as one where Armenian and Greek populations had combined population share that is above the 75th percentile of the corresponding distribution. Similarly, a low-minority district would have a combined minority share that is below the 25th percentile of the same distribution.

[38] This figure compares aggregate trends that reflect the role of (i) year specific common shocks, (ii) district-level factors that do not depend on time and (iii) time-varying factors that are specific to each district. In Figure C.3 in the Online Appendix we isolate the last component –driven by district-year level factors– of population density and show that it systematically varies between high- and low-minority regions. Even conditional on year and district fixed effects the divergence between these two groups is evident from the figure. This is consistent with the idea that minority legacy has a time-varying component, and its positive effect has become more visible over the years.

[39] This finding is not sensitive to including region, subregion or province fixed effects. There are seven regions, 21 subregions, and 81 provinces. Also, in Table C.5 of the Online Appendix, we show that results are robust to including 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.

[40] All our results remain qualitatively intact when we include Greek and Armenian shares separately or if we control for population density prior to mass expulsions instead of density in 1927.

[41] Acemoglu et al. (2002) estimate positive and strong cross-country correlations between urbanization and income per capita for early 20th century, mid-20th century and more recent time periods.

[42] See also Table C.4 in the Online Appendix.

[43] Online Appendix Table C.5 shows that results are robust to including incomplete Ottoman census regions.

relationship between historical minority presence and luminosity, once potentially confounding factors are accounted for. While the descriptive maps in Figure B.1 do not tell much about the conditional nature of these relationships, the evidence in Table 1 corroborates our earlier findings. Both Armenian and Greek shares are highly significant and positive predictors of modern economic development in 2000. Raising Armenian share from the 10th to the 90th percentile is associated with a 24.8 percent increase in average luminosity (see our baseline specification in column (8)).

Back of the envelope calculations based on the unconditional relationship between gross regional product per capita and average luminosity across Turkish provinces (Figure C.4 in the Online Appendix) suggest that these magnitudes are economically meaningful. A modern province with a historical Armenian share of 20 percent (90th percentile) is estimated to have 11 percent higher gross regional product per capita in 2000 than a province with no historical Armenian presence (10th percentile). At the average province income, this corresponds to about $260 per capita. The estimates for Armenian presence are sensitive to the omission of regional and geographic characteristics, reflecting the downward bias due to negative selection. We also identify a rather stable Armenian legacy based on within-subregion or within-province variations across Turkish districts. This finding alludes to the local nature of the influence of Armenian presence on regional development, an issue we further investigate in Section 6.

The estimated relationship between Greek share and luminosity is also significantly positive, and the magnitude is similar to that of Armenian share (column (8)). A move from the 10th to the 90th percentile implies a 32 percent increase in luminosity. Translating this into income, we conclude that a modern province with a historical Greek share of 26 percent (90th percentile) is estimated to have 14 percent higher gross regional product per capita in 2000 than a province with no historical Greek presence (10th percentile). At the average province income, this corresponds to about $335 per capita.[44] Partial correlation plots in Figure C.5 suggest that the associations we report are not driven by influential outliers.

5.2.2 Threats to Identification and Robustness

In this section, we perform several robustness analyses to demonstrate that the significant OLS results are not simply due to the omission of some observable factors that could potentially affect economic prosperity independently of minority presence. In Section 6, we show that a similar relationship between minority presence (proxied by location of Armenian and Greek community buildings) and density of nighttime lights hold in our empirical analysis at the level of villages and neighborhoods.

5.2.2.1 Threats to Identification In our baseline specification, we control for a wide range of geographic and climatic factors as well as suitability to cultivation that could affect agricultural productivity. We have also shown in Table 1 that our results remain qualitatively robust when we control for fixed effects for 21 subregions or fixed effects for 81 provinces in our baseline sample. Nonetheless, we cannot preclude the possibility that minority shares were subject to selection on other factors not accounted by our baseline controls. Here, we first summarize various sources of endogeneity bias, and then, give a brief overview of the strategies we employ in the subsequent sections to mitigate these identification problems.

[44] Online Appendix Table C.5 shows that our results are robust to including incomplete Ottoman census regions.

The main threat to our identification is the potential selection of minorities based on local drivers of development that we might have omitted from our regressions. If minority selection was positive, this would bias our estimates upwards. An alternative source of bias would be selective Muslim penetration across regions. If Muslim groups sorted into areas that offered greater economic potential regardless of minority presence, the concentration of non-Muslim population should be diluted over time. Such positive Muslim selection could bias our estimates on Greek and Armenian shares downwards. It is also possible that more productive people among Muslims self-selected into high minority regions. This selection could be due to locational fundamentals, other economic opportunities these locations offered to high skilled workers or certain attributes of minority groups living in these locations. Such high-skilled selection might explain persistently higher development in regions with higher minority shares even after the expulsions. When we discuss minority influence on regional human capital accumulation (see Section 7), we argue that this type of sorting may actually reflect an indirect minority legacy when, for example, the market forces that attract skilled Muslims were themselves an outcome of long-lasting minority presence. When, in one way or the other, sorting of high skilled Muslims was directly or indirectly driven by minority presence, we interpret this as a causal legacy effect of minority presence.

Our first strategy to address these endogeneity concerns is to control for various correlates of historical and contemporary development that may confound our minority share coefficients.[45] Second, we employ matching estimators as an alternative to OLS and compare locations with high and low minority presence that are similar with respect to exogenous geographic characteristics as well as possibly endogenous drivers of selective minority settlements or conversions. Matching allows us to more flexibly account for observable characteristics and it also improves identification by focusing on a smaller sample where treated and untreated districts are more similar. Importantly, we take into account early settlement patterns that might have been driven by development potential. To do that, we account for neolithic settlements across districts as well as ancient Greek and Armenian settlement patterns.[46]

We additionally run Oster (2017) test for coefficient stability to show that selection on unobservables is unlikely to explain away the positive coefficients of interest. Finally, in Section 6 we run a village/neighborhood level analysis where we use proximity to Armenian and Greek community buildings as a proxy for minority presence. Thanks to the much finer unit of analysis, in these regressions we can account for province and even district/sub-district fixed effects in addition to many other relevant observables. This setup enables us to investigate whether nighttime lights systematically vary by proximity to old minority settlements across localities that are otherwise highly comparable.

In what follows, we show that our baseline conclusions qualitatively survive all of these alternative strategies. Therefore, taken together, the evidence we provide makes a strong case for a causal legacy effect of Greeks and Armenians on current development.

[45] Also, comparing column (1) of Table 1 with column (8) of Table 1, Altonji et al. (2005) ratios are 4.3 for Armenians and 3.05 for Greeks. Therefore, these values are reasonably large for us to have confidence that selection on unobservables is unlikely to explain away our estimates.

[46] In principle, we can conduct an instrumental variables analysis in which group-specific ancient settlement patterns (e.g. locations of capitals to old Armenian kingdoms and locations of ancient Greek sites in Anatolia) are used as instruments that predict 19th century Armenian and Greek shares, respectively. In fact, such an empirical strategy results both in a strong first-stage and significantly positive coefficient estimates for minority shares in the second stage. However, in view of a possible violation of the exclusion restriction assumption, we do not pursue this strategy.

5.2.2.2 Robustness to Alternative Correlates of Development We check the robustness of the baseline OLS estimates to several potential correlates of historical and contemporary development. In the following discussion, we motivate each set of controls we introduce to our baseline model. The results of all robustness checks are presented in Table 2.

Access to Railroads and Ports: Regions with greater access to railroads or major port infrastructure in the past might have developed earlier than others (Donaldson and Hornbeck, 2016; Jedwab et al., 2015). Since railroad network might well be an outcome of the economic activity spurred by minorities, we control for access to railroads as further in the past as possible. Using maps of historical rail network around 1910, we calculate distances of districts to the nearest railroad. Similarly, to measure access to sea trade, we compute distances to the nearest major 19th century port.[47] Column (2) shows that controlling for these two variables does not alter our findings.

Exposure to War: Early 20th century was a period of constant warfare. The Ottoman Empire participated in WWI which in turn led to the Turkish Independence War (1919-1923). These wars were devastating for Anatolia both in terms of human casualties and material destruction. Thus, one concern is that regions that were more heavily affected by the destruction of war might have fallen behind others. If exposure to war correlates with minority presence, this would lead to biased estimates. Controlling for two measures of war in column (3), number of Ottoman soldiers who died in battle during the WWI and distance to the nearest war front in the Turkish Independence War, we show that our results are qualitatively unaltered.

Settlement of Migrants and Kurdish Presence: Late 19th and early 20th centuries were a period of involuntary migrations. To disentangle the long-run impact of minorities on current outcomes from the potential effect of incoming migrants, we account for the number of immigrants who settled in Turkish provinces over the period 1921-1929 as a fraction of provincial population in year 1927 as well as the shares of 1927 population born outside modern-day Turkey (by country of birth). Also, historically, Kurdish population was highly concentrated in the eastern and the southeastern part of Anatolia in the areas inhabited by Armenians. Even after accounting for region fixed effects and geographic factors, Kurdish presence may still influence local development. Accordingly, we control for the share of Kurdish speakers in 1927 population. Column (4) suggests that none alters our findings.

Historical Regional Centers: One may also think our results are biased due to self-selection of minorities into historically more central and urbanized locations. Indeed, that is likely and consistent with both historical evidence and our own regressions (not shown here). To mitigate this problem, in column (5) of Table 2, we use an indicator for modern districts that were assigned to the central district (merkez *kaza*) of a given Ottoman *sancak* (akin to a county). Yet, Armenian and Greek shares remain highly significant.

Distance to Istanbul and to the National Borders: Proximity to Istanbul as the historical capital of the Ottoman Empire and the most important economic center of Turkey (both now and in the past) is a strong predictor of economic activity today. In addition, proximity to national borders may influence the degree and types of economic activity. To address these concerns, in column (6), we control for distances to Istanbul and to the nearest national border. Results do not change.

[47] These ports were situated in Istanbul, Trabzon, Mersin, Iskenderun, Samsun and Izmir.

Distances to Old Trade Routes: Minorities might have selected into areas with greater trading potential, and those locations with greater trading advantage might have developed independently of minorities' contribution to economic activity. To explicitly address this problem, in column (7) of Table 2, we control for the distance to the Anatolian Silk Road as well as the distance to the Ottoman trade routes. Coefficients on Armenian and Greek shares remain highly significant, but reduced in size. However, it would be wrong to attribute the whole decline in estimated magnitudes to selective settlement. After all, it is highly likely that trade potential, and hence, the location of trade routes were themselves influenced by the persistent presence of these indigenous communities.

Finally, in column (8) of Table 2, all robustness controls are added to the baseline model simultaneously. The results suggest that, even in the presence of a fairly exhaustive list of potential confounders, our main conclusions about the minority legacy remain unchanged. We consider the estimates under this very stringent specification as the respective lower bounds. They suggest that a district at the 90th percentile of the Armenian population share distribution prior to the deportations had, on average, 12 percent higher luminosity in year 2000 than a district without Armenians, while the corresponding difference due to Greek presence is about 19 percent.

5.2.2.3 Matching Estimates. In this subsection, we carry out covariate and propensity score matching analyses. Matching estimators offer an appropriate comparison across treatment and control districts. Thus, better counter-factual control districts for the treated ones help mitigate endogeneity concerns. Also, restricting the analysis to the common support where treated and untreated units are more comparable improves upon identification.

We first construct Armenian and Greek treatment indicators with a value of one if the share of Armenians (Greeks) in that district is larger than the median Armenian (Greek) share across districts.[48] Given that the economic incentives of the time were mainly driven by agricultural activities, geographic and climatic characteristics, and suitability to cultivation must have influenced selection patterns. Therefore, we carry out our main matching exercise based on the exogenous geographic and climatic characteristics of the baseline model, namely, longitude, latitude, elevation, standard deviation of elevation, lake, sea, river dummies, temperature, precipitation, and suitability to cultivation.[49] We apply a two-sided common support to the propensity score, and restrict the sample to those treatment and control districts with overlapping propensity scores. In addition, we ensure that the balancing property is satisfied throughout.[50]

[48] Before we carry out our analysis to obtain the results in Table 4, we filter out subregion fixed effects both from minority shares and luminosity. This provides us with more comparable treatment and control units. In Panel A of the Online Appendix Table C.9, we reproduce the same matching exercise with treatment indicators generated from the median of the raw data without filtering out subregion fixed effects. The results are similar. In addition, in Panel B of the Online Appendix Table C.9, we provide results with another alternative treatment indicator, where treatment is set to one for districts with more than 1% minority share. The results are qualitatively the same. Therefore, our results are not sensitive to the definition of the treatment indicator.

[49] In the pre-treatment set of selection variables, only those variables that are unaffected by the treatment itself should be included. See Smith and Todd (2005) for a discussion on the choice of pre-treatment selection variables and which variables to include in the matching procedure. To ensure this, variables should either be fixed over time or measured before treatment.

[50] We ensure that the balancing property is satisfied as follows. We run the propensity score algorithm for the Armenian Treatment indicator and the balancing property is satisfied right away. This could be gauged already from Panel A of Table C.7 in the Online Appendix, where most of the covariates are balanced across treated and control districts. When we run the propensity score algorithm for the Greek Treatment indicator, however, the balancing property does not hold. This could be expected from the poor covariate balance in Panel B of Table C.7. We, then, trim the sample to the propensity

Panels A and B of Table 4 present the covariate (Abadie and Imbens, 2006; Abadie et al., 2004) and propensity score matching estimates (Rosenbaum and Rubin, 1983) of the average treatment effect of the Armenian and Greek treated districts (ATT) on luminosity with nearest neighbor, radius, kernel or stratification algorithms.[51] For comparison purposes, columns (1) and (2) show the OLS coefficients of minority treatments on the entire sample and on the common support.

In Panel A, the ATT of the Armenian presence under various matching methods ranges between 32.4% to 38.7%, always significant at the 1% level. The positive effect of the Armenian treatment under OLS in columns (1) and (2) is not very different from matching estimates, either on the entire sample or on the common support. In Panel B, the ATT of Greek presence increases luminosity by 47.7 to 63.6 percent. Moreover, OLS estimate on the entire sample seems underestimated compared to the coefficient of the regression on the common support.

Importantly, in Table C.10 of the Online Appendix, we confirm the robustness of our main results to matching on additional covariates of development, such as population density in 1893, distance to Istanbul, distances to railroads in 1910 and major ports, and distances to Anatolian silk road and Ottoman trade routes. Overall, our matching estimates suggest that districts with high historical minority concentration are more developed today even though they are no different in terms of other observable characteristics.

5.2.2.4 Accounting for Early Selection and Settlement Patterns. The most important challenge to disentangling the minority legacy from other location-specific characteristics is early selection and settlements based on economic potential. To address this concern, we account for three deep-rooted factors that potentially shaped pre-historic human settlement patterns in Anatolia over the course of history.

Based on archaeological data, we first take into account the density of Neolithic settlements as a proxy for prehistoric conditions that were favorable to agriculture and amenable to permanent settlement.[52] Second, we locate ancient Greek sites dating to the Classical (480-323 BC) and the Hellenistic (323-146 BC) periods.[53] Third, we compute distances of district centers to Tushpa (the city of Van in modern-day Turkey) which was the capital of the ancient Urartu (Van) Kingdom (860-590 BC). Kingdom of Urartu was the first unified Armenian State[54] and Tushpa was the economic, cultural and administrative center of attraction for Armenians.[55]

The results are presented in Table 3. Column (1) reproduces the baseline results, whereas column (2) introduces neolithic sites into the regression. We observe that while neolithic sites positively predict

score interval of [0.2,0.8] over which the overlap between treatment and control is better as Panel C of Table C.7 indicates. Under this restricted sample balancing property is satisfied. Then, we move on to carry out our matching exercises (Abadie et al., 2004; Becker and Ichino, 2002).

[51] Table C.8 in the Online Appendix shows the robustness of the results to alternative propensity score matching methods.

[52] Indeed, our regressions –not shown here– indicate that presence of neolithic sites predict higher agricultural suitability, one of the controls in our baseline model.

[53] While these sites predict geographic distribution of Ottoman Greeks in the late 19th century, a priori it is hard to rule out any influence they might have on modern development outcomes through other channels. Therefore, using ancient Greek sites as an instrument for 19th century Greek settlement patterns might not be a viable option.

[54] It also corresponds to the biblical Kingdom of Ararat.

[55] Distance to Tushpa might not only predict ancient Armenian settlement patterns but also early development and urbanization at the regional level. Therefore, using it as an instrument for the 19th century Armenian settlement patterns might not be a viable option.

modern economic development, the Armenian and Greek share coefficients are not changed. Thus, conditional on our baseline geographic controls, there is no evidence that Greek and Armenian legacy on current development is driven by the persistent and possibly positive influence of neolithic settlements. In column (3), we include a dummy for ancient Greek sites and the distance to Tushpa to account for ancient Greek and Armenian settlement patterns, respectively. Both variables are insignificant and hardly affect the minority coefficients. In column (4), we control for all three variables together, and the coefficients of interest remain remarkably stable. Finally in column (5), in addition to three early selection and settlement variables, we also control for all other robustness variables as in column 8 of Table 2. Even in this very stringent specification, Armenian and Greek shares maintain their positive and significant influence on modern development, albeit the magnitudes are naturally reduced.

These results demonstrate that the geographic distribution of Greek and Armenian communities in the late 19th century Ottoman Empire explains a significant part of the contemporary cross-district variations in development even after taking into account early selection and settlement patterns.

5.2.2.5 Evaluating the Possible Influence of Omitted Variables. To test for the possible importance of omitted variable bias, we employ a method recently developed by Oster (2017), which builds on the work by Altonji et al. (2005). The basic idea is that if the inclusion of controls does not affect the magnitude of coefficient estimates, we can be more confident in suggesting a causal interpretation for the estimated relationship. More specifically, one can compute the statistic δ which measures the degree of correlation between the unobservables and the variables of interest, relative to the correlation of the observables and the same variables of interest, that would be necessary to make the coefficients of interest equal to zero. An absolute value of 1 (or larger) for δ implies that the unobservables would need to be at least as important as the observables to produce a treatment effect of zero. Since researchers typically choose the controls they believe ex-ante to be the most important, absolute values of δ greater than 1 imply that it is unlikely that omitted variables are driving the results. However, as argued in Oster (2017), the coefficient movements due to additional controls should be scaled by the resulting change in R-squared. This adjustment in δ accounts for the fact that coefficient movements in response to less relevant controls are not as informative as the movements due to more relevant controls.

In Appendix Table C.6 we report the statistic δ proposed in Oster (2017) both for Armenian and Greek population shares in the late 19th century Ottoman Empire under two different controlled models.[56] As our restricted model we use a specification without any controls except subregion fixed effects. We first consider our baseline specification as the fully controlled model (column 8 in Table 1). The resulting proportionality of selection δ that is necessary to explain away the role of Armenian share is negative and sizable (-10.38). This finding implies that adding all relevant unobservables would need to (i) move the coefficient estimate in the opposite direction as the set of included observables does and (ii) selection on these unobservables have to be more than 10 times as important as the selection on observables to produce a treatment effect of zero. The corresponding δ for Greek share is more moderate, 2.67. Nevertheless, both δ values are high enough to give us more confidence about a causal interpretation.

[56]Following the rule of thumb suggested in Oster (2017), we compute δ under the assumption that if we could add all relevant unobservables in our model, the resulting R-squared would be 1.3 times as high as the R-squared of the fully controlled model (i.e. $R_{max} = 1.3 \times R^2$)

When we adopt the most stringent specification as our fully controlled model (column 5 in Table 3), we compute $\delta = 2.66$ for Armenian share. For Greek share, $\delta = 0.79$. Since the latter value is lower than unity, it raises a reasonable concern for zero treatment effect for historical Greek presence. Yet, one also needs to keep in mind that some of the robustness controls are likely to be endogenous to minority presence, such as Ottoman trade routes or railroad network, which are likely shaped by the urban and commercial centers minorities established in the first place. Overall, our findings maintain that omitted variable bias should be less of a concern for our coefficient estimates for the Armenian share than for the Greek share.

6 Village/Neighborhood Level Evidence

We believe that our district-level analyses in the preceding section goes a long way in establishing a positive and causal legacy effect. Armenian and Greek presence explain a non-negligible variation in current regional development; a result that is robust to a rich set of controls, and is corroborated by our matching analyses. We have also shown that selection on other omitted factors must be fairly strong to justify zero legacy effect of minority presence. Nonetheless, our district-level robustness checks cannot entirely rule out endogeneity problem.

In this section we use villages and neighborhoods (localities), instead of districts, as the unit of analysis. In particular, we exploit *within-district* variations in the *proximity to minority community buildings* across these localities instead of *within-subregion* variations in *minority population shares* across districts. In doing so, we are motivated by two related goals: Our primary goal is to evaluate the legacy of historical minority settlement patterns on the spatial organization of current economic activity at a highly localized level. Since in such a disaggregated analysis we are able to account for district-level fixed effects, we also rule out the potential bias due to selection of minority groups across districts within a subregion. Most of the unobservables that could independently shape both the historical distribution of economic activity as well as religious demography within a subregion or province become plausibly less relevant when we focus our attention to variations across villages and neighborhoods within a district.

We employ the geo-coded locations of community buildings as an alternative proxy for minority presence at the very local level. Besides the locational detail it offers, building data has the advantage that it plausibly captures a larger fraction of minority settlements (e.g. settlements that were largely abandoned before the expulsions) over the long history of Greeks and Armenians, rather than the snapshot the Ottoman census provides.

We regress luminosity on the presence of minority buildings in the close vicinity of more than 49,000 localities conditional on a large set of potential confounders. Our estimating equation is

$$(AvgLum5km)_i = \eta + \alpha(ArmBld5km)_i + \gamma(GreBld5km)_i + \theta'\mathbf{X_i} + \delta_i + \varepsilon_i \tag{2}$$

where i is a locality, either a village or a neighborhood. $(AvgLum5km)_i$ is the log of mean luminosity in year 2000 within 5km radius of i.[57] $(ArmBld5km)_i$ and $(GreBld5km)_i$ are binary variables indicating

[57]The circles around each point should be large enough to contain a reasonable number of luminosity pixels, but also sufficiently small to be representative of the natural boundaries of a given locality. We choose 5km as a reasonable trade-off between these two goals.

the presence of at least one historical Armenian and Greek community building within 5km of locality i, respectively. Figure C.6 in the Appendix presents the distribution of historical minority buildings.[58] $\mathbf{X_i}$ is a vector of geographic attributes as well as historical and contemporary correlates of development. Geographic attributes consist of longitude, latitude, altitude, distances to nearest major river, sea coast and lake. Historical correlates include an indicator for locations within 15 km to an Ottoman urban center (circa 1900) and distances to historical trade routes. Contemporary controls are an indicator of locality type (village or neighborhood), distance to modern railroad network, distance to nearest province center, and distances to each of the four biggest commercial/industrial centers (Istanbul, Izmir, Ankara, Bursa). Thanks to the fine geographical scale of the data, we are also able to account for province or district fixed effects denoted by δ_i, thereby, evaluating minority legacy using only the variations across localities within a given administrative unit.[59] A major advantage of including fixed effects at such a local level is that it leaves very little room for selection on unobservables to bias the estimates. We effectively compare locations that are not only geographically and culturally very close, but also governed by the same local administrative body. Therefore, such locations are very unlikely to vary with respect to omitted factors that may confound the causal relationship between minority presence and luminosity.[60]

Table 5 summarizes our results. Columns (1)-(7) use the entire sample, pooling together villages and neighborhoods, while column (8) uses villages only. We start in column (1) by introducing our variables of interest together with a dummy for location type. The next two columns introduce geographical controls and proximity to historical urban centers. Controlling for these variables reduces the coefficients of interest. Adding province or district fixed effects further dampens the effect of Greek presence, but does not affect the Armenian building coefficient. In column (6), we add distances to old trade routes to account for historical market access. Historical market access is an important correlate of minority presence and a strong predictor of local development even today. Yet, conditional on all of the previous controls, introducing trade routes does not statistically alter our coefficients of interest. In column (7), our most stringent specification together with contemporary controls implies that a location within 5km of an Armenian community building is 66 percent more lit up than another comparable location in the same district. Greek presence, on the other hand, is associated with an increase in luminosity by around 24 percent, a considerably smaller magnitude than the one for Armenian presence. One might be concerned that the results are driven by relatively more urbanized locations (mostly neighborhoods) rather than rural areas. It is likely that in historically more urban centers and towns Muslim and non-Muslim community buildings were more likely to cluster together. Then the latter buildings could simply proxy for the positive legacy of the former type of buildings. Since neighborhoods in our sample are mostly located inside or near the urban centers in each province, they are more prone to reflect the

[58] Given that we do not have minority figures at the neighborhood/village level from historical censuses, we proxy the long-run presence of minorities with minority community buildings in close vicinity. We choose to employ binary indicators because the number of buildings has an extremely right-skewed distribution, and thus, relatively small number of highly populated areas with an atypically large number of community buildings might otherwise drive the results. By using a building dummy, we can also better isolate the mere contribution of minority presence from the additional influence of the level of historical prosperity of the location. Lastly, using a binary indicator for community buildings help us minimize the measurement error.

[59] Median district has an area of $647km^2$ that is roughly equivalent to a 25km-by-25km square.

[60] Like in our district-level analysis, we drop Istanbul Province from the regression sample and cluster standard errors at the province level. Clustering at the district level produces even smaller standard errors.

confounding effect of old Muslim community buildings.[61] To address this, in column (8), we estimate our most stringent model on the sample of villages only, with the understanding that these locations are more likely to be situated in historically more rural areas where Muslim and non-Muslim community buildings were geographically more segregated. The resulting estimates are significantly more sizable.[62] Although minority presence is a strong predictor of both historical and contemporary urbanization rates –as established in our district-level analysis–, these findings suggest that the persistence of minority legacy on local development is not merely an urban phenomenon. Even though the mass expulsions possibly dealt a serious blow to the viability of affected localities, minority villages are far from losing out to historically Muslim villages. On the contrary, today, the places that were home to (or situated near) local Armenian and Greek communities are significantly more prosperous.

7 Potential Channels for Persistent Minority Legacy

Our results support the idea that over many centuries Armenian and Greek communities played an important role in shaping regional development patterns in Anatolia. We interpret our findings as evidence of a minority legacy, and argue that other explanations do not square with the historical context. One alternative explanation could be that expulsions led to higher development in high-minority regions since they reduced ethno-religious diversity. However, if diversity was detrimental to development, then, it is not clear why high-minority regions were ahead of more homogeneous regions even before the expulsions. One may alternatively argue for an intermediate and optimal level of diversity for development. Yet, with the expulsions, religious diversity in affected regions was reduced to zero, rather than approaching some optimal level. Thus, our results are very unlikely to be driven by a negative shock to religious diversity. Another consequence of mass expulsions was that it led to larger inflows of Muslim migrants in affected regions. If these immigrants were, as a whole, more skilled than the local Muslims, one could attribute the higher levels of prosperity today to these migration shocks. Yet, we have already addressed this concern by controlling for the size of Muslim groups that were resettled over the period 1921-1929. We also verify that controlling for 1927 population shares by birth place do not alter our qualitative results. Thus, we conclude that our findings are unlikely to be driven by expulsions per se.

Another seemingly competing hypothesis is that the republican government invested more heavily in high-minority regions. This explanation is a priori not at odds with our view of minority legacy. If true, such differential investment may simply be driven by greater development potential and hence higher return to infrastructure investment in ex-minority regions. In fact, as we argue in Section 7.2, an important goal of the state economic policy in the aftermath of the expulsions was to facilitate the emergence of a Muslim-Turkish bourgeoisie. This was achieved mainly through transfer of minority assets and generous subsidies to the local elite that would eventually become the first generation of businessmen

[61] Unfortunately, we are not aware of a database that provides information about the coordinates of old Muslim community buildings akin to the inventory of non-Muslim community buildings that we use to identify local Greek and Armenian settlements.

[62] All of our results remain qualitatively similar and economically sizable when we exclude observations with potentially censored outcomes (i.e. those with an average luminosity score of 63 or 0). The new estimates for the specification in column (7) of Table 5 suggest that average luminosity within 5km to a locality is 50 percent higher for localities that have at least one Armenian community building within the same radius relative to the localities without an Armenian building. The corresponding figure for Greek buildings is almost 30 percent. These results are available upon request.

and industrialists of the Republic. Therefore, if the government investments systematically targeted high-minority regions, it is hard to justify such a policy except through the fact that these regions offered better initial conditions (e.g. higher physical and human capital) to obtain successful outcomes.

Thus, our results are more likely to reflect the persistent influence of the higher rates of human capital and asset accumulation among the non-Muslim subjects of the empire, and the ensuing benefits to the Muslim populations interacting with these minorities or self-selecting into these locations. In what follows, we offer empirical evidence for these two broad channels.

7.1 Minorities and Human Capital Accumulation

Greeks and Armenians had a significant representation in highly skilled and educated segments of the Ottoman society. Just like Greeks,[63] investment in human capital among Armenians had historical roots. In Armenia Major (885-1045) and in the Cilician Armenian Kingdom (1198-1375), Armenians enjoyed persistent growth in science and culture. Elementary schools were subsidized by the state, and from the 9th century onward, Armenian state established institutions of higher education (Khachikyan, 2010). Even in the poorer eastern provinces such as Erzurum, human capital of the Armenian population and the knowhow of their artisans stood out vis-a-vis the Muslims (Kévorkian, 2011). While Greek and Armenian philanthropic agencies and religious institutions were channeling community resources into education, a significant majority of Muslims lacked adequate education and skills due to lack of sufficient investment. Ottoman administration's neglect of Anatolia deepened the discrepancies in the quality of educational institutions between non-Muslims and Muslims, and Figure C.2 supports this.

We conjecture that education levels today should also be higher in places with greater Armenian and Greek influence in the past, and thus, human capital acted as a mediating variable between historical minority presence and contemporary economic development. For example, eight centuries of co-existence is a sufficiently long period for inter-communal exchange between Muslims and non-Muslims to shape the attitudes and cultural values about the importance of education. Also, intergroup transmission of skills and knowledge in agriculture, craftsmanship, trade and commerce could be important drivers of human capital accumulation. Muslims working with or competing against non-Muslim minorities in the domestic market had an advantage in adopting superior knowhow and production techniques, compared to their counterparts without such exposure. Although some guilds were divided along religious and regional lines (e.g. bankers, butchers, porters), many of them were religiously mixed. Inter-communal economic ties were stronger in major economic centers and bigger cities. Anecdotal evidence from the late Ottoman period also suggests that different religious communities regularly interacted in the economic sphere.[64] For instance, in the province of Kayseri, the commercial relationships between Muslims and non-Muslims were very dynamic. The extent of economic integration was such that Muslims and non-Muslims not only traded and interacted on a constant basis, but they also had joint enterprises (Kekeçoğlu, 2007).[65] Even in the absence of inter-group human capital spillovers, emergence of modern sectors led by Armenian and

[63] Even in antiquity, education in gymnasium was considered essential in Greek culture, with plenty of examples of famous scientists and philosophers of Greek tradition and the important role of Greek education and science in world history.

[64] Local testimonies about social life in the town of Palu in Diyarbekir suggests that Kurds, Armenians and Turks regularly interacted in the town market and Palu male Armenians mastered Turkish and Kurdish due to economic incentives.

[65] For example, Parsihoglu Sahbaz ran a joint trading company together with Bodan, the son of Boyacioglu Karabet, and Migirdic, the son of Tazik. Kazancioglu Haci Agop and Kasagici Haci Efendi were merchant partners (Bayrak, 2003).

Greek entrepreneurs might have encouraged more human capital investment among the local Muslims or attracted highly skilled Muslim immigration.

If minority presence directly or indirectly facilitated human capital accumulation among Muslims, then, already before the expulsions, we may see differences in education levels of Muslims in high and low minority areas. Figure 6 shows exactly that by providing descriptive evidence from average primary school enrollment rates among Muslims in above and below median minority share Ottoman provinces in 1894/1895. Consistent with our hypothesis, Muslims who lived in high minority areas had greater primary school enrollment rates than Muslims who lived in low minority areas.

We test the same idea more thoroughly with the data on literacy rates from the 1927 Turkish Census. 1927 is the first Turkish census year after the expulsions, and a significant share of the Muslim population of the time must have coexisted with the minorities prior to expulsions. Also, it is crucial to recall that 99% of Turkey registered Muslim by 1927. Thus, literacy rates in 1927 capture the human capital of remaining Muslims, and not the direct contribution of non-Muslims. Figure 7 shows the relationships between literacy rates in 1927, and Armenian and Greek shares in 1893. Both panels of Figure 7 suggest that, even after accounting for pre-expulsion population density, literacy rates in 1927 among the Muslim residents are significantly higher in areas with higher Armenian and Greek share back in 1893. One percentage point increase in the historical Armenian share is associated with a 0.064 percentage point increase in the average literacy rate in 1927, while the same effect for the Greek share is 0.050 percentage point. These coefficients are economically sizable given the average literacy rate at the time was 5.9%. This means that a move from the 10th to the 90th percentile of the Armenian share (from 0 to 20%) increases literacy rate by 1.28 percentage points, which is more than one fifth of the average literacy rate of the time. These results are consistent with the human capital spillover hypothesis outlined above.

If the head start high-minority regions enjoyed in human capital accumulation persisted over time, then, in the contemporary period we should observe greater levels of education in historically high minority areas. We should also find that the correlation between minority presence and contemporary human capital is largely mediated by historical human capital. The district-level results in Table 6 support these predictions. The outcome variable in Table 6 is high school completion rates in 2000.[66]

Column (1) shows that Armenian and Greek shares in 1893 are positive and significant predictors of educational attainment in contemporary Turkey. In column (2), we include the literacy rates in 1927 into the specification so as to understand how historical human capital spillovers mediate the effect of Ottoman minorities on current educational attainments. Literacy rates in 1927 are a significant predictor of educational outcomes in 2000.[67] Strikingly, once the literacy rates in 1927 are taken into account, the association between minority shares and contemporary education becomes weaker. The Armenian and Greek coefficients drop by 28 and 38 percents, respectively, upon controlling for literacy rates in 1927 (comparing Armenian and Greek coefficients in columns (1) and (2)). This suggests that part of the legacy of minorities on current educational attainment is indeed through their contribution to the historical human capital levels of their Muslim coinhabitants –as in Figures 6 and 7.

[66]Results are very similar if we instead use university completion rates in 2000 as an outcome variable.

[67]In column (2) we also control for the share of 1927 population younger than 13 and the female-male ratio to isolate the part of literacy that is not driven by gender gap in educational attainment or the age structure of the population.

To better identify the human capital channel, we employ data on the locations of historical school buildings owned by various minority communities as of 1912.[68] Then, we take the ratio of the number of Armenian or Greek school buildings within a district to the size of the Muslim population in 1893. To the extent that school buildings capture the degree of human capital accumulation at the local level, this variable proxies the intensity of exposure to Armenian or Greek human capital by an average Muslim individual before the expulsions. It also allows us to better capture the variation in human capital of the members of each minority group who lived in different regions. This way we can test the human capital influence at the intensive margin. Typically, the degree of interaction among ethnoreligious groups was greater in more urban centers of the Empire compared to rural places where settlements are more dispersed and segregated. Thus, one would expect human capital spillovers to be stronger in more central urban locations.[69] In columns (3) and (6), we capture the effect of Armenian and Greek schools per Muslim in central versus non-central locations on contemporary educational attainment. As expected, minority schools per Muslim enter positively in central locations. Higher Armenian schools per Muslim in 1893 positively and significantly predict educational attainment in 2000. The sign of the Greek schools per Muslim is also positive. While it is not precisely estimated in column (3), it is significant at the 5 percent level in column (6) when we control for robustness variables.

In columns (4) to (6), we repeat the same exercise controlling for historical robustness variables and the conclusions are the same. Exposure to minority human capital in the past positively predicts modern human capital levels.

In sum, the evidence from this subsection suggests that the presence of historical Ottoman Armenian and Greek minorities positively impacted local human capital accumulation for Muslim residents, and this persistent influence is reflected in contemporary education outcomes.

7.2 Confiscation of Minority Assets and the Rise of Muslim Capital

> *The movable property left by the Armenians should be conserved for long-term preservation, and for the sake of an increase in Muslim businesses in our country, companies need to be established strictly made up of Muslims. Movable property should be given to them under suitable conditions that will guarantee the business' steady consolidation. The founder, the management and the representatives should be chosen from honorable leaders and the elite, and to allow tradesmen and agriculturalists to participate in its dividends, [...]*
>
> From Minister of Interior Talaat Pasha's empire-wide decree about the businesses confiscated in the genocide (6 January 1916).

After the expulsions, part of the properties and the productive assets Armenians and Greeks left behind, such as community buildings, land plots, shops and factories, were either plundered by regular citizens or unlawfully captured by the local elite. They were also confiscated by the state and eventually sold to the public, mostly to the connected elite (Üngör and Polatel, 2011).[70] There is abundant

[68] These data are from the Hrant Dink Foundation's cultural heritage inventory project. See Data Appendix.

[69] A series of studies show cities help disseminate knowledge (Glaeser et al., 1995; Gennaioli et al., 2013; Moretti, 2004).

[70] 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"

anecdotal evidence that state officials and local notables received a disproportionate share of minority assets especially after the Armenian expulsions.[71]

Historical anecdotes also suggest that the regions where more Armenians lived were also the regions where post-expulsion asset grabbing was more intense. Since minority assets were not equally redistributed among the Muslim population, asset inequality should indeed be increasing in minority shares. If expulsions and unequal redistribution of minority property led to greater asset concentration, high minority presence and greater minority wealth might have facilitated the emergence of a new Muslim bourgeoisie and fueled capital accumulation. Indeed, the local elite who received disproportionately more out of expropriated minority assets could in principle establish more viable businesses and larger scale enterprises over the early years of the Turkish Republic compared to those regions without significant minority presence. If so, then we should expect persistently higher asset concentration in high minority regions and particularly in those places where minority asses were distributed unequally.

The ideal way to test this asset concentration hypothesis would be to compare the distribution of private assets held by the Muslim population before and after the expulsions and see how the difference is related to the level of confiscated minority assets. Historical data that is necessary for such an analysis is not available.[72] Instead, we use a contemporary proxy for asset concentration. Employing district-level information on land holdings of households in 1997,[73] we construct a Gini index for land holdings. We combine these with district-level information on the number of minority community buildings per 1935 population to proxy for the historical minority assets per capita in the post-expulsion period.[74] We then explore whether our historical proxies for minority presence and minority assets predicts higher land concentration today. Table 7 presents our results.

In the first column, we look at the effect of minority shares on land concentration in 1997, conditional on our baseline controls. As expected, minority shares in the past positively predict modern asset concentration. However, these results should be interpreted with caution as our asset concentration measure is imperfect. In column (2), we estimate the legacy of the historical minority buildings. Although, historical Armenian buildings significantly and positively predict land concentration in 1997, we observe no significant effect for Greek buildings. This may reflect the difference between how the asset capture process and the subsequent redistribution of minority assets unfolded for Greeks compared to Armenians. In other words, more unequal redistribution of Armenian assets compared to the Greek assets might be driving these results. While Armenian property was more subject to looting and elite capture, the

(Emval-i Metruke Idare Komisyonları) and the "Liquidation Commissions" (Tasfiye Komisyonu) were established. These commissions were tasked with collecting detailed information about the assets of the deportees and assessing their value.

[71] Üngör and Polatel (2011) mention, among many other examples, the case of some Muslim immigrants who arrived in Adana Province around 1924. When the local government could not provide them proper places to settle, they sent telegrams to the central government to complain about the unequal distribution of abandoned properties and how state officials hogged the land and houses that once belonged to Armenians.

[72] Data on confiscated properties are not available. Üngör and Polatel (2011) write that the notebooks of the 33 Abandoned Properties Commissions are 'lost'.

[73] With this information, we generate a land holdings concentration variable that is an approximation of a Gini index applied to the size distribution of land plots owned by households.

[74] Since Ottoman census figures are reported for Ottoman districts whose boundaries we do not know, we cannot normalize minority buildings by historical minority population. Instead we divide the number of buildings that fall within each modern district by the total population of that district in 1935. We use population figures in 1935 instead of those in 1927 to ensure that the first wave of post-expulsion resettlements of Muslim immigrants and reallocation of minority property would be largely completed. We do not choose later years because otherwise the population figures would be less representative of the Muslim population that was directly involved as beneficiaries in the initial capture and redistribution of the minority assets.

redistribution of Greek property was less chaotic and under the control of the state. Greek property was more systematically and orderly redistributed to Muslim refugees coming from Greece, the Balkans as well as local Muslims who have lost their own properties during the period of war. In column (3), we include both minority shares and minority buildings into the regression. Previous conclusions carry over. In columns (4) to (6) instead, we repeat the same exercises controlling for all robustness variables.

Overall, the results from Table 7 are supportive of our asset transfer hypothesis for Armenians. We further argue that concentration in land holdings and wealth must have facilitated investment during the early stages of Turkish economic development, when capital was scarce and financing constraints were more binding. The other possibility is that the level of productive assets contributed to subsequent development regardless of how unequal they were distributed. Anecdotal evidence from the aftermath of the Genocide suggests that the government transferred minority property to Muslim merchants or used auction revenues to subsidize Muslim enterprises.[75] We investigate this possibility in the next section.

7.3 Relevance of Intermediating Channels in Explaining Average Luminosity

In Table 8, we evaluate the relevance of minority legacy on regional human capital and minority assets in explaining modern development. To do so, we regress average district-level luminosity between 2007-2013 on minority shares and then introduce the intermediating variables we have proposed in the preceding sections. Our goal is to evaluate whether the predictive power of minority presence on development operates through these variables.[76]

The first column shows our baseline luminosity regression. In columns (2)–(4) we assess the relevance of the human capital channel. When either literacy rates in 1927 or high school completion rates in 2000 are added on the right-hand side, the minority share coefficients are significantly reduced relative to our benchmark estimates in column (1). According to Sobel-Goodman mediation tests, literacy rates in 1927 or high school completion rates in 2000 individually explain 45 percent and 48 percent of the conditional correlation between Armenian share and contemporary nighttime lights. Corresponding fractions for Greek share are about 30 percent and 40 percent respectively. In column (4) we add both intermediating variables simultaneously. Coefficient for Armenian population share is further reduced and becomes statistically insignificant while the Greek share remains significant.

Columns (5)–(8) explore the relevance of minority assets. Both historical Armenian and Greek community buildings predict significantly higher luminosity, however, this effect disappears after conditioning on minority population shares (see columns (5) and (6)). Coefficients on minority shares in column (6) are virtually no different compared to the ones in column (1). Whereas, minority community buildings –as a proxy for the level of minority assets– by itself do not mediate the effect of minority shares on luminosity.

In columns (7) and (8), we assess the mediating role of land inequality conditional on the level of historical minority assets. When we control for land concentration and minority buildings simultaneously, the estimates for Armenian and Greek shares are reduced by 24 and 13 percents respectively. Sobel-

[75] Üngör and Polatel (2011) note that as a result of these policies "[...] a whole generation of Turkish-owned firms, 'established in 1916', mushroomed across the empire."

[76] Educational attainment and land concentration measures we introduce in the right-hand side are reported for the years 2000 and 1997 respectively. Therefore, unlike in the previous analyses, here we do not use luminosity in 2000 to alleviate reverse causality issues.

Goodman tests suggest that the variation in contemporary land inequality mediate only about 15 percent of the total effect of Armenian share and 10 percent of the total effect of Greek share.

In sum, our district-level analysis suggests that the concentration of Armenian (but not Greek) assets and the degree of contemporary land inequality seem to account for some part of the reduced-form effects of minority shares on luminosity. However, these indirect effects are not as important in magnitude as the mediating role of historical or contemporary education.

Finally, in Table 9 we explore the relevance of human capital channel at the level of villages and neighborhoods by distinguish between school and non-school community buildings. We investigate whether proximity to a Greek or Armenian school building matters for local development above and beyond the legacy of other types of community buildings. Specifically, we analyze whether being situated within 5km of a minority school building translates into higher luminosity once we account for the density of other community buildings.[77] In the first three columns, we use the entire sample of villages and neighborhoods, while in the last three columns, we limit the analysis to villages only. Regardless of the sample, presence of a school building, be it Greek or Armenian, explains differences in nighttime lights even across locations with similar minority presence (Columns (2) and (5)), and similar historical and contemporary characteristics (Columns (3) and (6)). The estimated coefficients for school dummies are statistically significant at conventional levels. As expected, estimated magnitudes get smaller as we add more controls and district fixed effects. Our most stringent specification suggests that predicted luminosity is about 40 and 23 percent higher around localities that are near an Armenian or Greek school than otherwise. These are economically substantive effects at the local level. The estimates are somewhat larger in the limited sample of villages, but less precisely estimated for Greek schools.

8 Concluding Remarks

This paper studies the long-run economic legacy of highly-skilled minorities and the channels of persistence, long after those minorities are expelled en masse. We offer evidence that the centuries-long presence of the two largest non-Muslim minorities of the Ottoman Empire, Armenians and Greeks, has significantly shaped the regional patterns of Turkish development. In particular, we find that, in modern day Turkey, districts with greater presence of historical Armenians and Greeks about a century ago are more densely populated, more urbanized, and more developed today. Using a large sample of villages and neighborhoods in Turkey we also establish a strong legacy of minority settlements on the current distribution of night lights at a highly local level. The estimates are sizable and very unlikely to be driven by endogenous selection.

We provide evidence on the channels through which Armenian and Greek presence might have shaped the regional outcomes. In particular, we show that Muslim residents of districts with greater exposure to Greek and Armenian presence were more educated in the past and 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. We also explore the intermediating role of minority assets that were confiscated in the aftermath of the expulsions. We find some evidence

[77] Here our implicit assumption is that conditional on the density of non-school buildings, the presence of a school building near a given locality is an appropriate proxy for the human capital of the minority community near that locality.

of Armenian and Greek legacy on contemporary land inequality that plausibly resulted from unequal redistribution of confiscated assets. However, this legacy appears to be weaker for Greeks and does not seem to be important for regional development, at least relative to minority legacy on human capital.

Taken together, our results bear significance beyond its particular historical context. They suggest that a social and institutional environment that is conducive to peaceful co-existence of different ethno-religious groups can foster beneficial outcomes for the society at large. More specifically, positive externalities and spillovers of human capital across groups might have long-lasting effects that go beyond their originators. While a large body of empirical work on ethnic diversity generally points to adverse consequences at global and national levels, our results seem to lend some *qualified* support for an optimistic view of historical diversity over the long-run.

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FIGURES AND TABLES

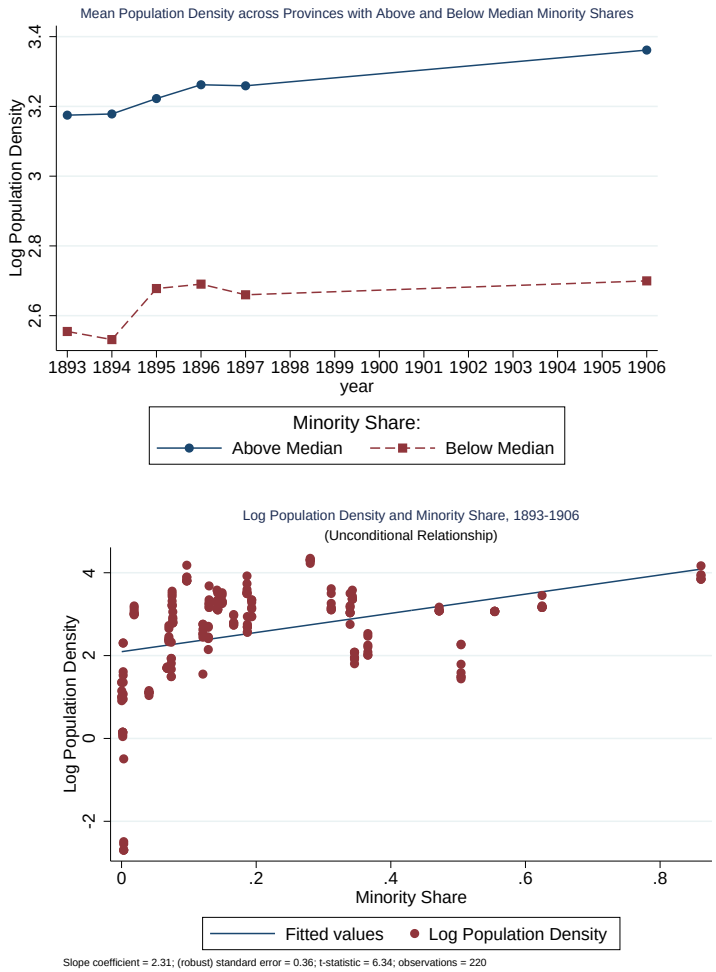

FIGURE 1: Minority Presence and Population Density in Ottoman Provinces

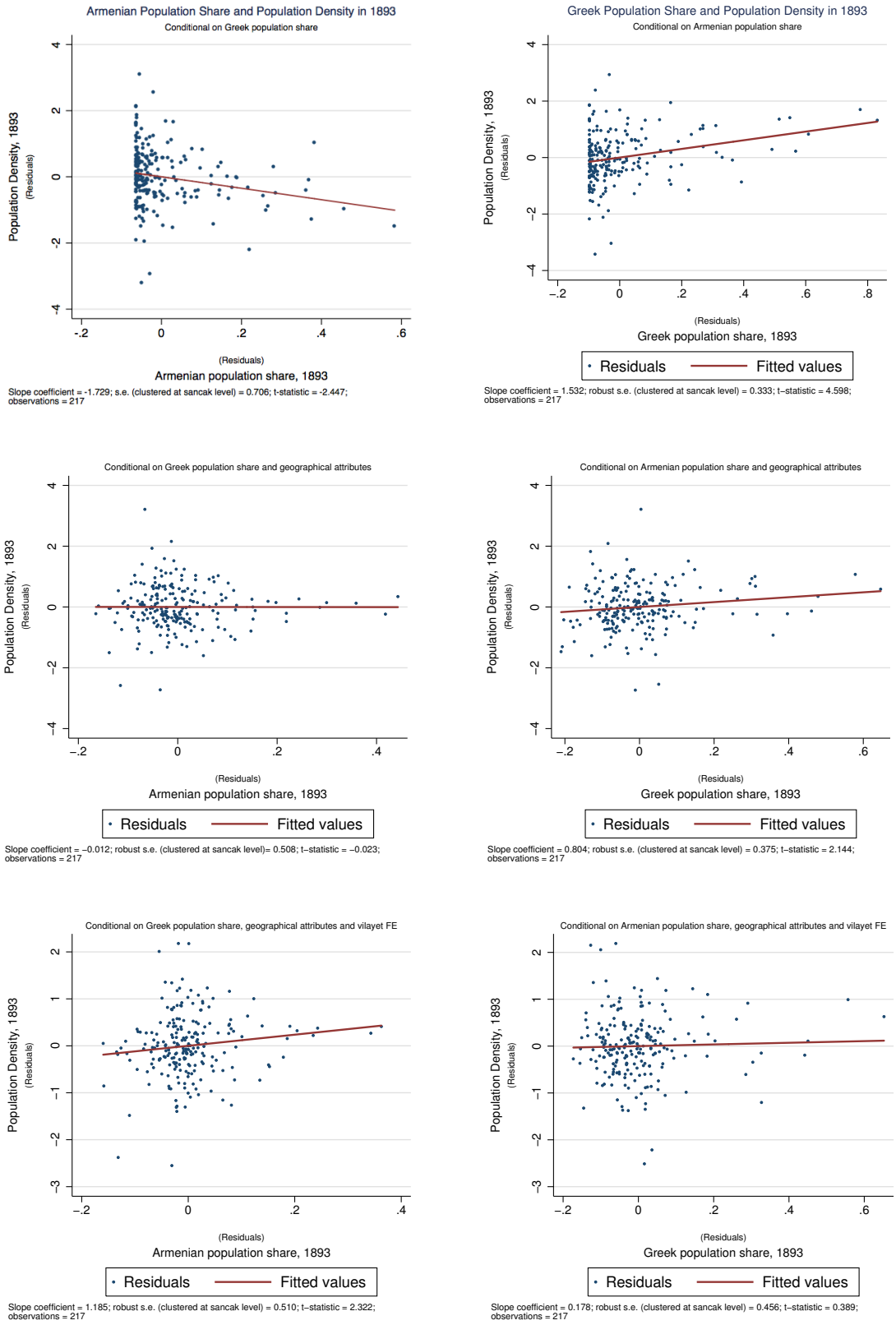

FIGURE 2: Pre-expulsion conditions: Minority shares and population density in 1893

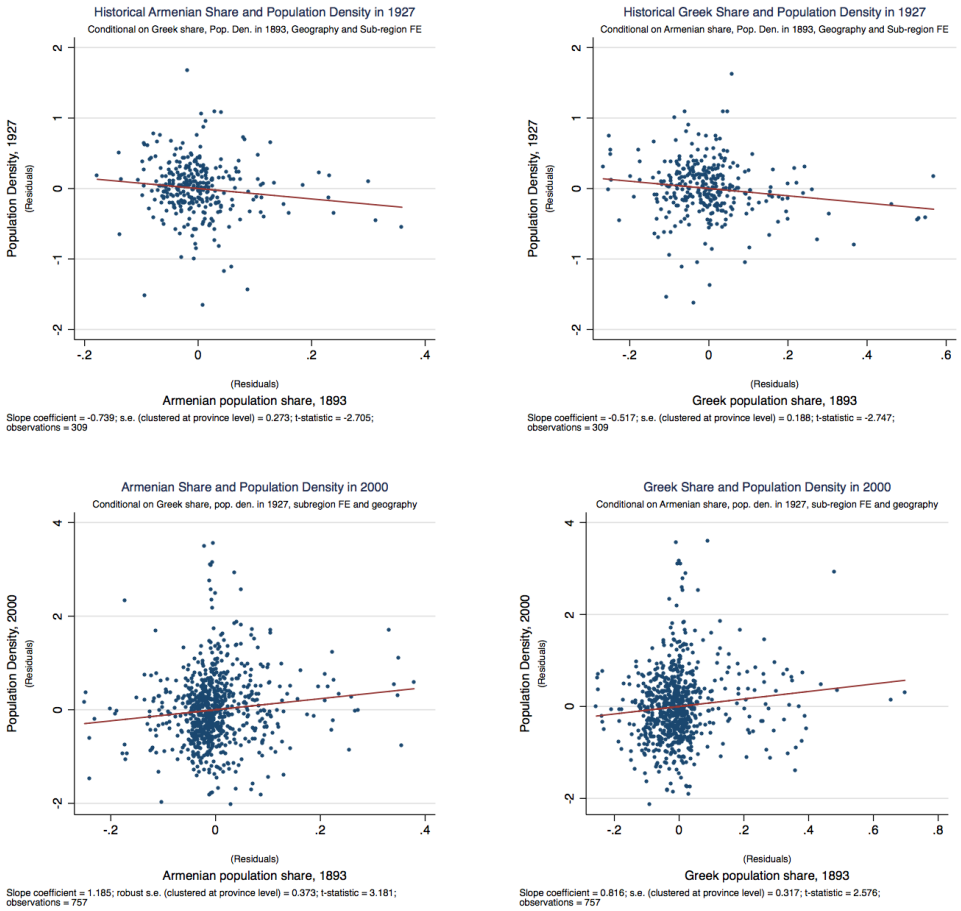

FIGURE 3: The short-term impact of expulsions and the long-run legacy of minority presence on population density

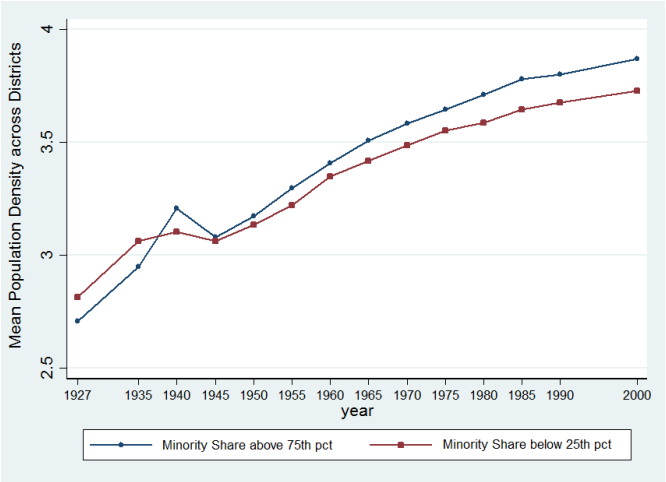

FIGURE 4: Post-expulsion Population Trends, 1927-2000

Notes: This figure plots for each census year the averages of the natural logarithm of population density for two groups of modern Turkish districts: Those where the sum of historical population shares of Armenians and Greeks (i.e. minority share) is above the 75th percentile of the corresponding cross-district distribution, and those where it is below 25th percentile.

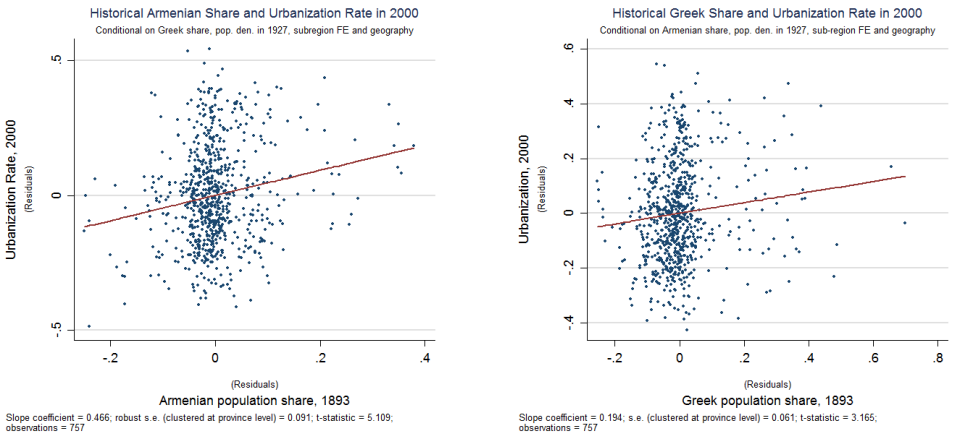

FIGURE 5: The long-run legacy of minority presence on urbanization rates

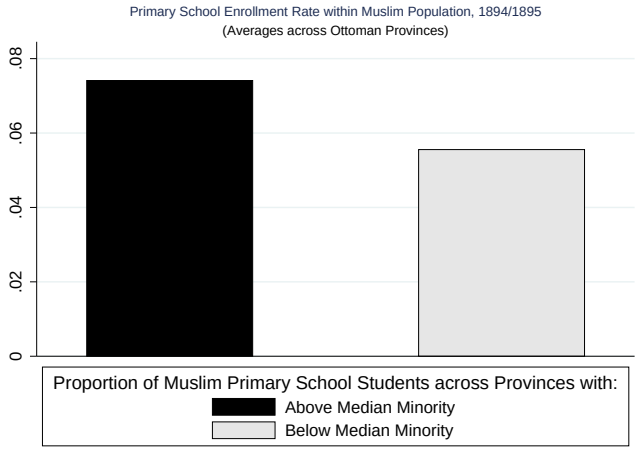

FIGURE 6: Educational attainment among Muslims in High vs. Low Minority Provinces, 1894/1895

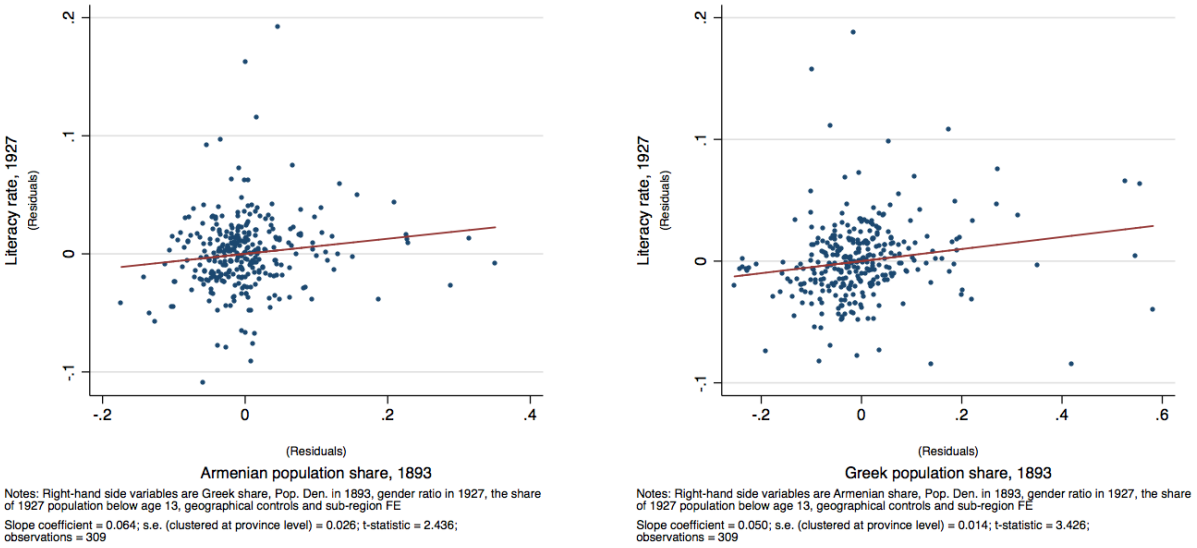

FIGURE 7: Historical Minority Presence and Literacy in 1927

Table 1: Historical Minority Shares and Average Luminosity in 2000

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) OLS	(8) OLS	(9) OLS
	Log(Average Luminosity in 2000)								
Armenian population share, 1881-1893	0.961**	1.334***	1.532***	1.462***	1.518***	1.416***	1.406***	1.250***	1.242***
	[0.378]	[0.464]	[0.404]	[0.489]	[0.419]	[0.393]	[0.357]	[0.372]	[0.362]
Greek population share, 1881-1893	1.648***	1.791***	1.825***	1.355***	1.126***	1.099***	1.447***	1.241***	0.694***
	[0.347]	[0.340]	[0.342]	[0.303]	[0.299]	[0.306]	[0.295]	[0.296]	[0.218]
Log(Population density, 1927)	0.715***	0.801***	0.818***	0.664***	0.649***	0.663***	0.678***	0.678***	0.683***
	[0.086]	[0.088]	[0.084]	[0.089]	[0.083]	[0.082]	[0.079]	[0.084]	[0.085]
Effect of increasing Armenian share	19.122**	26.546***	30.484***	29.086***	30.214***	28.182***	27.979***	24.874***	24.710***
from the 10-th to the 90-th percentile	[7.527]	[9.230]	[8.030]	[9.721]	[8.335]	[7.813]	[7.097]	[7.412]	[7.195]
Effect of increasing Greek share	42.487***	46.170***	47.036***	34.918***	29.024***	28.326***	37.287***	31.995***	17.884***
from the 10-th to the 90-th percentile	[8.943]	[8.773]	[8.816]	[7.818]	[7.712]	[7.895]	[7.598]	[7.622]	[5.621]
Observations	757	757	757	757	757	757	757	757	757
Adjusted R-squared	0.289	0.321	0.322	0.433	0.458	0.460	0.497	0.513	0.596
Longitude & Latitude			×	×	×	×	×	×	×
Mean & std. of elevation				×	×	×	×	×	×
Lake, sea and major rivers					×	×	×	×	×
Temperature & Precipitation						×	×	×	×
Suitability to cultivation							×	×	×
Modern region dummies		×	×	×	×	×	×		
Modern subregion dummies								×	
Modern province dummies									×

Notes: This table presents results from the regressions of Log Average Luminosity in 2000 on historical minority shares controlling for past population density, geographic variables, region, subregion or province fixed effects. The estimated effect associated with increasing minority shares from the tenth to the ninetieth percentile of their respective cross-district distributions is expressed in terms of % change in the level of average luminosity in district. Robust standard errors, clustered at the modern Turkish province (*il*) level, are reported in square brackets. *** denotes statistical significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level.

Table 2: 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	(8) OLS
	Log Average Luminosity in 2000							
Armenian population share, 1881-1893	1.250***	1.033***	1.240***	1.164***	1.103***	1.075***	0.846**	0.587*
	(0.372)	(0.347)	(0.371)	(0.347)	(0.385)	(0.355)	(0.339)	(0.315)
Greek population share, 1881-1893	1.241***	1.067***	1.238***	0.957***	1.179***	1.123***	0.797***	0.729**
	(0.296)	(0.281)	(0.295)	(0.296)	(0.312)	(0.253)	(0.270)	(0.293)
Log(Population density, 1927)	0.678***	0.577***	0.667***	0.652***	0.667***	0.685***	0.474***	0.446***
	(0.084)	(0.085)	(0.080)	(0.077)	(0.081)	(0.084)	(0.065)	(0.068)
Modern sub-region dummies	×	×	×	×	×	×	×	×
Baseline geographical controls	×	×	×	×	×	×	×	×
Distances to Railroad in 1910 & Major 19th century port		×						×
Distance to war front, 1919-1922			×					×
WW1 casualties in province			×					×
Share of settled immigrants in province, 1921-1929				×				×
Shares of 1927 population born outside modern-day Turkey (by country of birth)				×				×
Share of Kurdish speakers in province, 1927				×				×
In central kaza or sancak					×			×
Distances to Istanbul & nearest national border						×		×
Distance to Anatolian Silk Road							×	×
Distance to Ottoman Trade Routes							×	×
Observations	757	757	757	757	757	757	757	757
Adjusted R^2	0.513		0.515	0.522	0.515	0.523	0.587	0.600
Effect of 10th–90th %ile move in Armenian share	24.874***	20.565***	24.677***	23.154***	21.942***	21.386***	16.827**	11.680*
	(7.412)	(6.899)	(7.390)	(6.903)	(7.660)	(7.073)	(6.752)	(6.263)
Effect of 10th–90th %ile move in Greek share	31.995***	27.506***	31.902***	24.660***	30.385***	28.947***	20.542***	18.796**
	(7.622)	(7.235)	(7.603)	(7.626)	(8.047)	(6.522)	(6.962)	(7.547)

Notes: This table presents results from the regressions of Log Average Luminosity in 2000 on historical minority shares controlling for past population density, geographical variables, historical correlates of economic development, and subregion fixed effects. The estimated effect associated with increasing minority shares from the tenth to the ninetieth percentile of their respective cross-district distributions is expressed in terms of % change in the level of average luminosity in district. Robust standard errors, clustered at the modern Turkish province (*il*) level, are reported in square brackets. *** denotes statistical significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level.

Table 3: Minority Shares and Average Luminosity. Accounting for Neolithic and Ancient Settlement Patterns

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS
	Log Average Luminosity in 2000				
Armenian population share, 1881-1893	1.250***	1.273***	1.189***	1.213***	0.553*
	(0.372)	(0.388)	(0.371)	(0.386)	(0.319)
Greek population share, 1881-1893	1.241***	1.218***	1.185***	1.168***	0.659**
	(0.296)	(0.297)	(0.302)	(0.303)	(0.300)
Log(Population density, 1927)	0.678***	0.673***	0.678***	0.674***	0.447***
	(0.084)	(0.087)	(0.085)	(0.087)	(0.068)
Any settlement from Neolithic period		0.178**		0.165**	0.086
		(0.076)		(0.076)	(0.071)
Any ancient Greek site			0.182	0.165	0.142
			(0.114)	(0.114)	(0.097)
Log distance to Tushpa (Van)			−0.160	−0.155	−0.148*
			(0.103)	(0.100)	(0.083)
Modern sub-region dummies	×	×	×	×	×
Baseline controls	×	×	×	×	×
All other robustness controls					×
Observations	757	757	757	757	757
Adjusted R^2	0.513	0.516	0.515	0.518	0.601
Effect of 10th–90th %ile move in Armenian share	24.874***	25.340***	23.666***	24.144***	10.994*
	(7.412)	(7.722)	(7.380)	(7.682)	(6.354)
Effect of 10th–90th %ile move in Greek share	31.995***	31.401***	30.540***	30.117***	16.980**
	(7.622)	(7.655)	(7.792)	(7.805)	(7.727)

Notes: This table demonstrates that geographic distribution of Greek and Armenian communities in the late 19th century Ottoman Empire explains a significant part of the contemporary cross-district variations in nighttime light density even after we account for three deep-rooted factors that potentially shaped pre-historic human settlement patterns in Anatolia over the course of history. The first factor is the location of Neolithic settlements documented in TAY database of archaeological settlements in Turkey. These settlements likely capture the locations that were relatively more conducive to domestication of animals and plants, and indicate greater pre-historic agricultural potential. The second factor is the location of ancient Greek sites dating to the Classical (480-323 BC) and the Hellenistic (323-146 BC) periods. While these sites predict geographic distribution of Ottoman Greeks in the late 19th century, a priori it is hard to rule out any influence they might have on modern development outcomes through other channels. The third factor is the distance from Tushpa (the city of Van in modern-day Turkey) which was the capital of the ancient Van (Urartu) Kingdom (860-590 BC). Kingdom of Urartu was the first unified Armenian State. Distance to Tushpa could therefore not only predict ancient Armenian settlement patterns but also early development and urbanization at the regional level. Robust standard errors, clustered at the level of modern Turkish province (*il*), are reported in square brackets. *** denotes statistical significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level.

Table 4: Minority Presence and Luminosity: Matching Estimates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
			Covariate Matching	Propensity Score Matching			
	OLS	OLS	Nearest Neighbour	Nearest Neighbour	Radius (r=0.05)	Kernel (bw=0.02)	Stratification
	Panel A: Armenian Treatment Estimates (Dep.Var.: Log Average Luminosity in 2000)						
Armenian Treatment	0.302	0.298	0.348	0.292	0.328	0.316	0.304
Armenian Treatment (Bias Adjusted)	-	-	0.308	0.281	0.327	0.319	0.300
Bootstrapped Standard Errors	[0.084]***	[0.084]***	-	[0.093]***	[0.070]***	[0.071]***	[0.069]***
Analytical Standard Errors	(0.084)***	(0.085)***	(0.079)***	(0.091)***	(0.072)***	-	(0.068)***
Treatment effect (%)	35.3	34.7	36.1	32.4	38.7	37.6	35.0
Treatment Districts	-	-	372	372	372	372	372
Control Districts	-	-	379	201	379	379	379
Common Support	No	Yes	Yes	Yes	Yes	Yes	Yes
Balancing Property Satisfied	-	-	-	Yes	Yes	Yes	Yes
Number of observations	758	751	751	573	751	751	751
	Panel B: Greek Treatment Estimates (Dep.Var.: Log Average Luminosity in 2000)						
Greek Treatment	0.378	0.405	0.414	0.382	0.495	0.399	0.416
Greek Treatment (Bias Adjusted)	-	-	0.397	0.390	0.492	0.403	0.416
Bootstrapped Standard Errors	[0.090]***	[0.077]***	-	[0.094]***	[0.076]***	[0.071]***	[0.072]***
Analytical Standard Errors	(0.086)***	(0.082)***	(0.086)***	(0.098)***	(0.078)***	-	(0.073)***
Treatment effect (%)	45.9	49.9	48.7	47.7	63.6	49.6	51.6
Treatment Districts	-	-	279	279	278	279	278
Control Districts	-	-	322	152	322	322	323
Common Support	No	Yes	Yes	Yes	Yes	Yes	Yes
Balancing Property Satisfied	-	-	-	Yes	Yes	Yes	Yes
Number of observations	758	601	601	431	600	601	601

Notes: This table presents the covariate and propensity score matching estimates of the average treatment effect on the Armenian and Greek treated districts (ATT), in Panels A and B respectively. Armenian and Greek Treatment indicators are equal to 1 for above median shares of respective distributions after having filtered out subregion fixed effects. Subregion fixed effects are also filtered out of the dependent variable, luminosity. The baseline exogenous variables that are used in the matching procedure are longitude, latitude, elevation, standard deviation of elevation, lake, sea, river dummies, temperature, precipitation, and suitability to cultivation. To ensure that balancing property is satisfied, we trim the sample for the Greek treatment to the propensity score interval of [0.2,0.8]. We show two sets of ATT estimates that are either uncorrected or corrected for small sample bias due to non-exact matches. Nearest neighbor matching with random draw is applied in column (4). The Epanechnikov kernel (bandwidth=0.02) is applied in column (6). Bootstrapped standard errors (1000 replications) are given in brackets, while analytical standard errors are given in parentheses (both type of standard errors are clustered at the province level for OLS). *** denotes statistical significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level.

Table 5: Minority Legacy on Local Development – Village/Neighborhood Level Analysis

Sample:	All villages and neighborhoods							Villages only
	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) OLS	(8) OLS
	Log Average Luminosity (in 2000) within 5km radius of village/neighborhood							
Armenian building within 5km	1.081***	0.819***	0.614***	0.708***	0.636***	0.572***	0.507***	0.671***
	(0.124)	(0.089)	(0.089)	(0.081)	(0.074)	(0.067)	(0.067)	(0.069)
Greek building within 5km	1.650***	0.770***	0.578***	0.346***	0.341***	0.286***	0.215***	0.483***
	(0.167)	(0.091)	(0.089)	(0.061)	(0.079)	(0.075)	(0.077)	(0.145)
Village dummy	×	×	×	×	×	×	×	×
Geographical controls		×	×	×	×	×	×	×
Near an Ottoman city			×	×	×	×	×	×
Distance to historical trade routes						×	×	×
Contemporary controls							×	×
Province FE				×				
Bucak/District FE					×	×	×	×
Observations	49321	49321	49321	49321	49321	49321	49321	18288
Adjusted R^2	0.223	0.364	0.389	0.478	0.629	0.638	0.644	0.500
Effect of having an Armenian community building within 5km	196.421***	128.528***	85.941***	103.681***	89.569***	77.696***	66.555***	97.171***
	(36.854)	(20.324)	(16.624)	(16.453)	(14.007)	(11.975)	(11.188)	(13.652)
Effect of having an Greek community building within 5km	424.282***	114.889***	76.871***	41.645***	40.859***	33.379***	24.149**	62.345***
	(88.032)	(19.697)	(15.749)	(8.700)	(11.120)	(10.018)	(9.611)	(23.630)

Notes: Dependent variable is log average luminosity (measured in year 2000) within 5km radius around the village/neighborhood centroid. Geographical controls are *distances to nearest major river, sea coast and lake, altitude, longitude and latitude. Near an Ottoman city*=1 if the village/neighborhood is within 15km of an Ottoman city centroid. Historical trade routes are Anatolian Silk Road (circa 1200-1400 CE) and Ottoman Trade routes (circa 1300-1600 CE) as in OWTRAD database. Contemporary controls are dummy for villages, distance to nearest province center, distance to contemporary railroad network, distances to commercial/industrial centers (Istanbul, Izmir, Ankara and Bursa). Istanbul Province is omitted from the sample, leaving 80 provinces. Standard errors are clustered at the province level. Marginal effects reported in the bottom two rows show how much (in percentage terms) higher average luminosity within 5km would be if there was at least one minority building within 5km to the locality as opposed to none.

Table 6: Minorities, Minority Schools and Educational Attainment – District Level Evidence

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
	High school completion rate in 2000					
Armenian population share, 1881-1893	0.109***	0.079***	0.059*	0.055*	0.040	0.030
	(0.030)	(0.025)	(0.034)	(0.028)	(0.027)	(0.030)
Greek population share, 1881-1893	0.107***	0.067**	0.087**	0.085***	0.065**	0.072*
	(0.030)	(0.030)	(0.038)	(0.032)	(0.032)	(0.036)
Log(Population density, 1927)	0.020***	0.001	0.017***	0.006	−0.005	0.005
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Share of literate people in population (1927)		0.386***			0.373***	
		(0.068)			(0.060)	
Pop. share of age<13 in 1927		0.024			0.021	
		(0.104)			(0.098)	
Female/Male ratio (1927)		−0.020			0.010	
		(0.024)			(0.026)	
# Armenian school buildings/Muslim in 1893						
in non-central kaza/sancak			44.478			44.039
			(29.630)			(30.871)
in central kaza/sancak			135.414***			126.575**
			(46.825)			(49.199)
# Greek school buildings/Muslim in 1893						
in non-central kaza/sancak			−0.308			0.268
			(0.366)			(0.364)
in central kaza/sancak			23.156			41.050**
			(17.821)			(17.904)
central kaza/sancak			0.015***			0.012**
			(0.005)			(0.006)
Modern sub-region dummies	×	×	×	×	×	×
Baseline geographical controls	×	×	×	×	×	×
All robustness controls				×	×	×
Observations	757	757	757	757	757	757
Adjusted R^2	0.293	0.354	0.322	0.358	0.398	0.375
Effect of 10th–90th %ile move in Armenian share	2.158***	1.563***	1.161*	1.084**	0.791	0.595
	(0.590)	(0.499)	(0.671)	(0.549)	(0.538)	(0.604)
Effect of 10th–90th %ile move in Greek share	2.744***	1.718**	2.229**	2.191***	1.675**	1.840**
	(0.762)	(0.759)	(0.971)	(0.827)	(0.825)	(0.929)

Notes: This table presents results from the district level regressions of high school completion rate in 2000 on historical minority shares, literacy rates in 1927 and the number of minority school buildings per Muslim in 1893, controlling for past population density, geographic baseline controls, subregion fixed effects. In addition, in columns (4)–(6) we include all robustness controls introduced previously. The estimated effect associated with increasing minority share from the tenth to the ninetieth percentile of its cross-district distribution is expressed in terms of percentage points change in the share of population who successfully completed high school.Robust standard errors, clustered at the level of modern Turkish province (*il*), are reported in square brackets. *** denotes statistical significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level.

Table 7: Transfer of minority assets and contemporary land concentration

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
	Land Concentration, 1997					
Armenian buildings per 1935 population		41.866***	33.615**		31.402**	26.980**
		(15.054)	(14.768)		(13.080)	(12.853)
Greek buildings per 1935 population		−0.216	−6.956		0.622	−5.822
		(4.580)	(4.729)		(4.809)	(4.602)
Armenian population share, 1881-1893	0.126***		0.106**	0.101**		0.090**
	(0.043)		(0.042)	(0.039)		(0.038)
Greek population share, 1881-1893	0.102***		0.121***	0.108***		0.126***
	(0.034)		(0.033)	(0.034)		(0.034)
Modern sub-region dummies	×	×	×	×	×	×
Baseline controls	×	×	×	×	×	×
All robustness controls				×	×	×
Observations	751	751	751	751	751	751
Adjusted R^2	0.228	0.219	0.232	0.254	0.245	0.255
Effect of 10th–90th %ile move in Armenian share	2.416***		2.032**	1.945**		1.727**
	(0.820)		(0.800)	(0.756)		(0.740)
Effect of 10th–90th %ile move in Greek share	2.627***		3.119***	2.787***		3.244***
	(0.864)		(0.848)	(0.870)		(0.864)
Effect of 1 sd increase in the number of Armenian buildings		0.095***	0.076**		0.071**	0.061**
		(0.034)	(0.033)		(0.030)	(0.029)
Effect of 1 sd increase in the number of Greek buildings		−0.002	−0.052		0.005	−0.043
		(0.034)	(0.035)		(0.036)	(0.034)

Notes: This table presents results from the district level regressions of Land Holdings Concentration in 1997 on historical minority shares, and the number of minority buildings per 1935 population, controlling for population density in 1927, baseline geographic controls, and subregion fixed effects. In columns (4)–(6), we additionally include all the previously introduced robustness controls. Robust standard errors, clustered at the level of modern Turkish province (*il*), are reported in square brackets. *** denotes statistical significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level.

Table 8: Relevance of Intermediating Channels: Human Capital, Minority Assets and Luminosity

Channel :		Minority Legacy on Human Capital			Role of Minority Assets			
	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) OLS	(8) OLS
	Dependent Variable: Log Average Luminosity, 2007-2013							
Armenian population share, 1881-1893	1.047***	0.575*	0.542*	0.438		0.923***	0.890***	0.792**
	(0.305)	(0.303)	(0.299)	(0.301)		(0.321)	(0.289)	(0.307)
Greek population share, 1881-1893	1.301***	0.925***	0.765***	0.729***		1.274***	1.173***	1.124***
	(0.274)	(0.245)	(0.246)	(0.236)		(0.322)	(0.266)	(0.320)
Literacy rate, 1927		6.389***		3.805***				
		(0.822)		(0.814)				
High school completion rate, 2000			5.108***	3.315***				
			(0.530)	(0.637)				
Armenian buildings per 1935 population					258.269*	186.056		144.511
					(140.788)	(148.911)		(152.592)
Greek buildings per 1935 population					74.653**	4.009		12.606
					(35.026)	(35.229)		(36.312)
Land Holdings Concentration, 1997							1.252***	1.236***
							(0.368)	(0.369)
Modern sub-region dummies	×	×	×	×	×	×	×	×
Baseline controls	×	×	×	×	×	×	×	×
Observations	751	751	751	751	751	751	751	751
Adjusted R^2	0.524	0.603	0.607	0.624	0.507	0.524	0.539	0.538

Notes: This table presents results from the district level regressions of average luminosity between 2007-2013 on various potential intermediating variables through which minority legacy on regional development operates. We consider two main channels. Columns (1)–(4) employ historical and contemporary educational attainment as intermediating variables to assess the extent to which minority presence mattered for development through its influence on human capital accumulation. Columns (5)–(8) employ number historical minority community buildings per 1935 population and the Land Holdings Concentration for contemporary land holdings as intermediating variables to assess the extent to which minority presence mattered for development through its influence on asset accumulation and land concentration. In all specifications we control for past population density in 1927, geographic baselines controls, and subregion fixed effects. Robust standard errors, clustered at the level of modern Turkish province (*il*), are reported in square brackets. *** denotes statistical significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level.

Table 9: Minority Schools and Local Development – Village/Neighborhood Level Evidence

Sample:	All neighborhoods and villages			Villages only		
	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
	Log Average Luminosity (in 2000) within 5km					
Armenian school building within 5km	1.400***	0.627***	0.334***	0.659***	0.442**	0.361***
	(0.125)	(0.131)	(0.072)	(0.154)	(0.214)	(0.092)
Greek school building within 5km	1.621***	0.732***	0.212**	1.456***	0.807***	0.317*
	(0.186)	(0.129)	(0.100)	(0.124)	(0.236)	(0.182)
Log(1+# of Armenian non-school community buildings within 5km)		0.515***	0.285***		0.168	0.516***
		(0.104)	(0.065)		(0.216)	(0.063)
Log(1+# of Greek non-school community buildings within 5km)		0.560***	−0.077		0.708***	0.164
		(0.099)	(0.053)		(0.185)	(0.099)
Geographical controls			×			×
Near an Ottoman city			×			×
Distance to historical trade routes			×			×
Contemporary controls			×			×
Bucak/District FE			×			×
Observations	49321	49321	49321	18288	18288	18288
Adjusted R^2	0.187	0.209	0.645	0.023	0.030	0.503
Effect of having an Armenian school building within 5km	308.012***	87.856***	39.929***	94.602***	56.396*	44.074***
	(51.090)	(24.721)	(10.063)	(30.302)	(33.864)	(13.407)
Effect of having a Greek school building within 5km	408.779***	108.667***	23.707*	333.501***	125.653**	37.400
	(94.861)	(27.065)	(12.442)	(54.517)	(53.539)	(25.086)

Notes: Dependent variable is log average luminosity (measured in year 2000) within 5km radius around the village/neighborhood centroid. In Columns (1)–(3) we include all neighborhood and villages in the regression sample but control for a village dummy. Regressions in Columns (4)–(6) use only villages. Geographical controls are *distances to nearest major river, sea coast and lake, altitude, longitude and latitude. Near an Ottoman city*=1 if the village/neighborhood is within 15km of an Ottoman city centroid, and zero otherwise. Historical trade routes refer to Anatolian Silk Road (circa 1200-1400 CE) and Trade routes in the Ottoman Empire (circa 1300-1600 CE) as reported in OWTRAD database. Contemporary controls include distance to nearest province center, distance contemporary railroad network, distances to biggest commercial/industrial centers (Istanbul, Izmir, Ankara and Bursa). Like in district-level analysis, Istanbul Province is omitted from the sample, leaving 80 provinces. Standard errors are clustered at the province level. The effects reported in the bottom two rows show how much (in percentage terms) higher luminosity within 5km is predicted to be –keeping all other variables at their sample means– if there is at least one minority school building within 5km to the locality as opposed to none.

APPENDICES FOR ONLINE PUBLICATION

A Data Appendix

Variable Definitions and Sources

Population Density: Natural logarithm of district population per square kilometer. It is computed using the Turkish Population Censuses 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. As for the 1893 population density, where it is necessary, we use a rough proxy. 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 in 1893 for each *kaza*.

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

Average Luminosity: The variable measures for a given year the density of time-stable nighttime lights at the district level. The information on light density comes 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. Figure B.1 depicts the cross-district distribution of average luminosity in 2000 along with the historical representation of Armenians and Greeks in the Ottoman population. Darker shades show districts with lower economic activity proxied by luminosity. In regression tables where we control for contemporary variables measured in year 2000, we employ the average luminosity for the period 2007-2013 as our outcome measure instead of luminosity in year 2000. For years in which luminosity is recorded by multiple satellites, we use the arithmetic average of the values in these rasters.

Historical Minority Population Shares: There are two potential sources of data on historical population of minorities. The first one is the Ottoman General Census of 1881/82-1893. The second one is the Population Statistics of the Ottoman State in 1914, i.e. the year before the mass deportations of Armenians started.

The 1914 statistics were prepared using the figures from the 1905/1906 census, and adjusting for births and deaths registered in the subsequent years. Various tribes in Eastern Anatolia could not be counted, and hence, the information on the population size of these tribes was based on estimates. More importantly 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 also gained momentum in this period. In some regions, Armenians organized armed self-defense forces in response to attacks by Kurdish tribesmen and irregulars. Armenian revolutionary activity in the

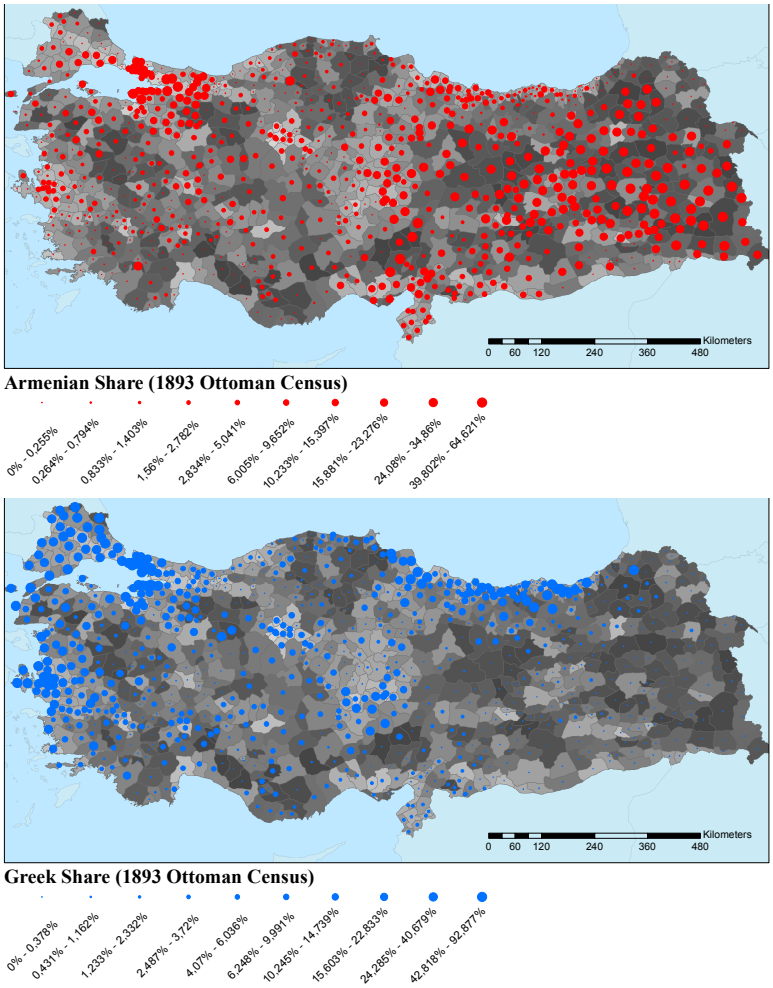

FIGURE B.1: Minority presence (1893) and average luminosity (2000) across Turkish districts

East and the ensuing violence were met with a heavily 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 the Hamidian Regiments –irregular corps armed by the state and named 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 the Armenian uprisings, and the 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. In addition, the Young Turk government, who took power in 1908 and initiated the Turkification of Anatolia, had incentives to under-report minority figures to deny them higher representation in the state and the military, which makes 1914 population numbers less reliable (Üngör and Polatel, 2011).

Therefore, 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 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). 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. There were a few areas within the modern Turkish boundaries –namely, Erzurum, Bitlis, Elaziz and Van– where the census counts were known to be incomplete due to the practical difficulty of counting nomadic tribes. Although the Ottoman statistical office reported the names of the specific vilayets, sancaks, and tribes for which counts were incomplete and provide population estimates for these areas, these estimates are unreliable and are not available at the Ottoman district level. Therefore, in our main analysis, we drop all modern districts that were mapped to Ottoman locations with incomplete Census counts, rather than using unreliable estimates for uncounted tribes and making heroic assumptions about how they were distributed across Ottoman districts within a given sancak/vilayet. Otherwise, the population 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 share in Ottoman district d is computed as

$$\text{Armenian Share}_d = \frac{\text{Armenian Population}_d}{\text{Total Population}_d} \tag{3}$$

Greek population share is calculated likewise. To each modern Turkish district i, we assigned the Ottoman district $d(i)$ that contained or largely overlapped with i. Therefore, historical Armenian/Greek share district i was exposed to is given by Armenian $\text{Share}_{d(i)}$.

Mapping Ottoman kazas (districts) listed in the 1893 Census onto modern Turkish districts is a challenging task because historical maps contain no information about the boundaries of kazas. 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 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. In most of the cases, an Ottoman kaza is either matched with a single modern district or with multiple modern districts, as an Ottoman kaza is usually geographically larger than a modern district.For some modern districts, especially those that are established during the Turkish Republic in areas where there was no settlement during the Ottoman period, it was not possible to identify the kaza or sancak that contains these areas. For these districts, we relied on other sources (mainly web sites of the local state administrations and municipalities) offering information about the history of the district, including where in the Ottoman administrative hierarchy it was. Figure B.2 presents the distributions of Armenian and Greek populations across modern districts in year 2000.

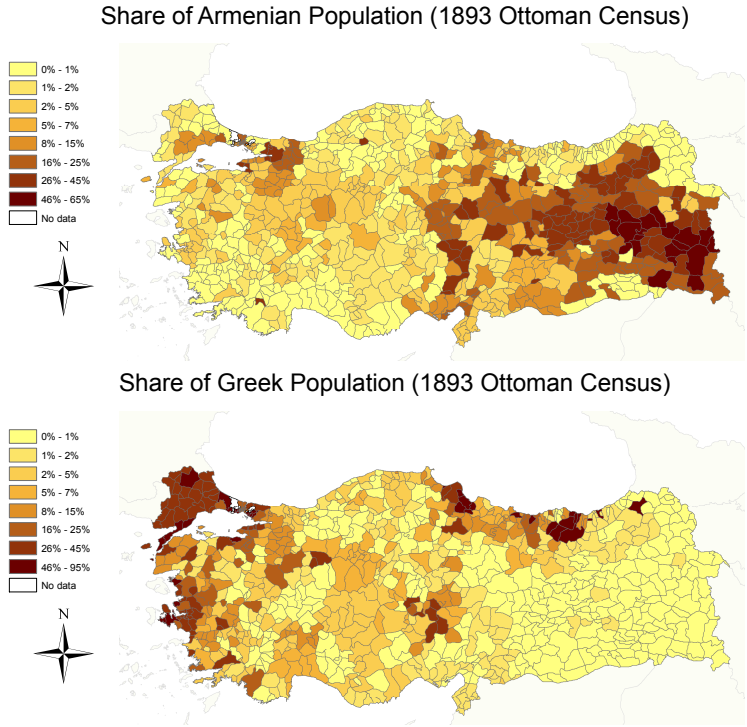

FIGURE B.2: Minority Shares in the late 19th century Ottoman Empire

Estimated Minority Population Shares: In Table C.5, we include in our sample those regions with incomplete population counts, and for Ottoman districts in these regions we impute estimated population shares as follows: For each Ottoman province or sancak with incomplete census counts, first we take the estimated (but admittedly unreliable) figure for uncounted population as reported by the census authorities. Records suggest that almost all these uncounted groups are nomadic Muslim tribes. Therefore, we distribute the uncounted population to each Ottoman district in that given province or sancak based on what fraction of the Muslim province/sancak population lived in that particular district. Formally, the estimated Armenian share in such a district is computed as

$$\text{Est. Arm. Share}_d = \frac{\text{Arm. Pop.}_d}{\text{Total Pop.}_d + \text{Est. Uncounted Pop.}_{p(d)} \left(\frac{\text{Muslim Pop.}_d}{\text{Muslim Pop.}_{p(d)}} \right)} \tag{4}$$

where $p(d)$ denotes the Ottoman province or sancak where district d is located. Estimated Greek share is calculated likewise.

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 Standard Deviation of Elevation: Average elevation and the standard deviation of elevation in a given district. Raw elevation data are downloaded from DIVA-GIS in Grid format. These data are 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. Standard deviation of elevation 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 standard deviation of elevation 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: These variables 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 of the Crop with Greatest Potential: 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 are 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.

Distance to Railroad in 1910: The logarithm of distance of a district (in kilometers) to the nearest railroad in 1910. The image file showing the Anatolian railroads in 1910 is downloaded here and digitized using ArcGIS®software. Distance calculations are also made using ArcGIS®.

Distance to Major 19th Century Port: The logarithm of distance of a district (in kilometers) to the nearest major 19th century port. The following were the major ports of the 19th century: The ports

of Constantinople (Istanbul), Izmir (Smyrna), Samsun, Trabzon, Mersin, and Iskenderun (Alexandretta). The spatial computations are made using ArcGIS®software.

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

Share of immigrants in province who arrived and were settled during 1921-1929: The number of immigrants in a given province in Turkey who settled during 1921-1929 period. We divide this number by 1927 province population. *Source:* Turkish Statistical Yearbook, 1930, Vol. 3.

Shares of 1927 population born outside modern-day Turkey: These four variables measure, at the district level, the shares of 1927 Census population whose birth place is (i) Albania, (ii) Greece, (iii) Romania and (iv) other places outside modern-day Turkey. *Source:* 1927 Population Census of the Republic of Turkey.

Share of Kurdish Speakers in province in 1927: Source data give us the number of Kurdish speakers in the total population in a given province in 1927. These data come from the 1927 population Census of the Republic of Turkey.

Central kaza/sancak dummy: A dummy which takes a value of 1 if the district in question is matched either to the central kaza (the central Ottoman district) of a sancak or to 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.

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 of 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.

Distance to Anatolian Silk Road: The logarithm of distance of a district (in kilometers) to the nearest Anatolian Silk Road. The spatial computations are made using ArcGIS®software. The primary source is the Old World Trade Routes (OWTRAD) Project.

Distance to Ottoman Trade Routes: The logarithm of distance of a district (in kilometers) to the nearest Ottoman Trade route. The spatial computations are made using ArcGIS®software. The primary source is the Old World Trade Routes (OWTRAD) Project.

Settlement from Neolithic period: Dummy for the presence of at least one pre-historic settlement within the district boundary that is dated by the archaeologists to the Neolithic period in Anatolia. *Source:* Databases of the Archaeological Settlements of Turkey Project (TAY). The database for Neolithic settlements can be accessed through http://tayproject.org/Neosearcheng.html.

Ancient Greek Site: Dummy for the presence of at least one ancient Greek site within the district boundary. These sites are either dated to the Classical (480-323 BC) or the Hellenistic (323-146 BC) period. The spatial computations are made using ArcGIS®software. The primary source is the Ancient-Greece project.

Distance to the Capital Tushpa (Van) of the Ancient Armenian Kingdom of Urartu (860-590 BC): The logarithm of distance of a district (in kilometers) to Tushpa (Van) which was the capital of the ancient Armenian Kingdom of Urartu (860-590 BC). The spatial computations are made using ArcGIS®software.

Literacy rate in 1927: The share of 1927 population in the district who is recorded as literate. *Source:* 1927 Census of the Turkish Republic.

High School completion rate in 2000: We use 2000 Census figures to compute district level high school completion rates among the population aged 6 and above. When computing the completion rates we exclude from this base population those respondents whose education status is unknown. 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.

Number of Armenian and Greek School Buildings per Muslim in 1893: Ratio between the number of Armenian or Greek school buildings within a district as of 1912 and the number of Muslims in that district in 1893. The spatial computations are made using ArcGIS®software. The primary source for minority school buildings is the Cultural Heritage Map of Turkey which was created as part of the Hrant Dink Foundation's cultural heritage inventory project. The project documents and maps Armenian, Greek, Syriac, and Jewish community buildings in Turkey. Although the data is the most comprehensive inventory of minority buildings to date, it is not fully complete. For example, Greek buildings are relatively under-documented compared to Armenian buildings.

Land Concentration in 1997: Source data for our measure of land inequality come from 1997 Village Inventory published by State Institute of Statistics of the Turkish Republic. This inventory provides various statistics based on the information collected from all localities with a village status and aggregated to the district level. We use data on land plots owned by households that are grouped into 11 land size brackets. For each district, we have information about (i) number of individual land plots, (ii) total size of land plots, and (iii) number of land owning households that fall into each land size bracket. Since we do not have household level data on the size of land holdings, we approximate a Lorenz curve for land size distribution among households under two strong but inevitable assumptions. We assume that (a) within each land size bracket, total land is distributed equally among households in that bracket, and (b) treat households owning multiple land plots as separate households. Under these assumptions, we can order households by the size of their land holdings into 11 categories (k=1,2,...,11) and compute for each district (1) the cumulative share of households X(k) that fall into a land size category of k or below, and (2) the cumulative share Y(k) of total land (in terms of size) in the district that is owned by these households such that X(11) = 1 and Y(11) = 1. Using this Lorenz curve for discrete categories

of households, we approximate an index, akin to Gini coefficient, for land distribution that is equal to $G = 1 - \sum_{j=1}^{11}[X(j) - X(j-1)] * [Y(j) + Y(j-1)]$ where X(0) = Y(0) = 0.

Number of Armenian and Greek Buildings per square kilometer: The number of Armenian or Greek community buildings (as of 1912) within district boundary d of that district divided by the land area of the district in km. The spatial computations are made using ArcGIS®software. The primary source for minority buildings is the Hrant Dink Foundation's cultural heritage inventory project.

B Appendix for Supplementary Figures and Tables

(A) Armenian Homeland throughout History (B) The Byzantine Empire by 1025

FIGURE C.1: Armenian and Greek Homelands

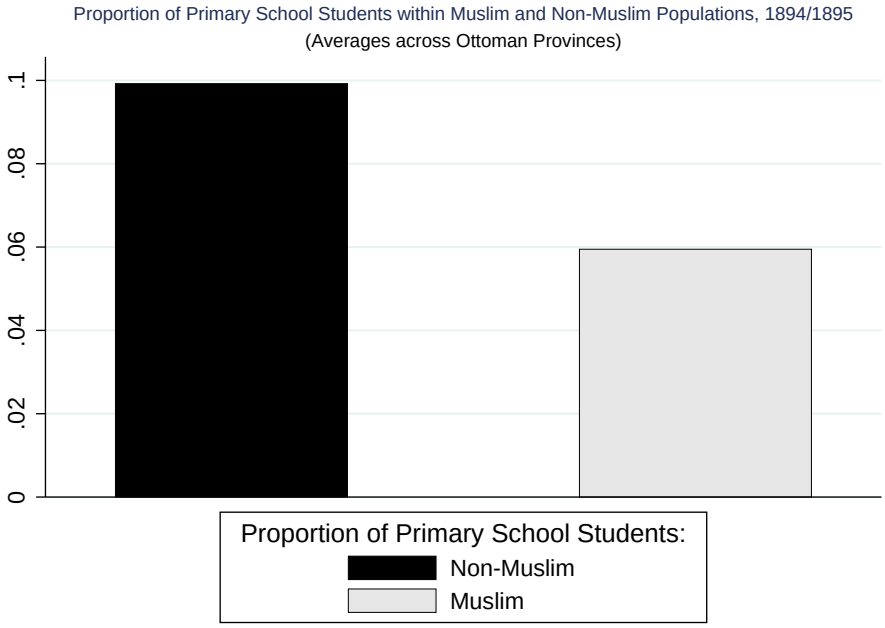

FIGURE C.2: Average Minority-Muslim Education Gap in Ottoman Provinces, 1894/1895

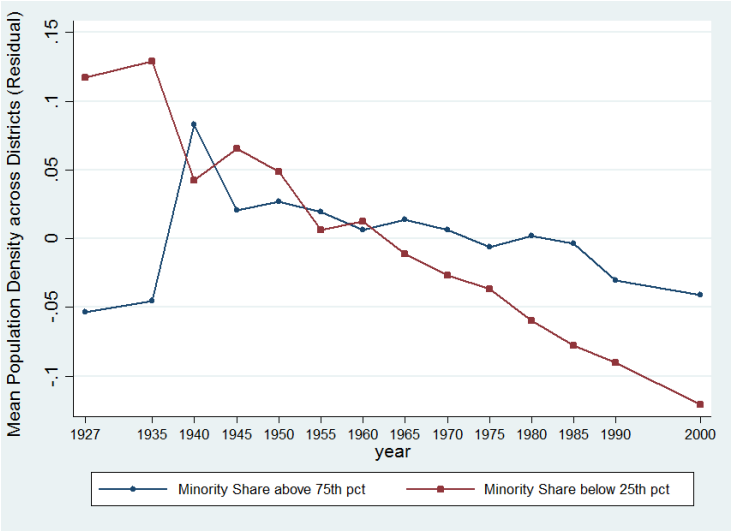

FIGURE C.3: Post-expulsion Population Trends After Accounting for District and Year Fixed Effects, 1927-2000

Notes: This figure plots for each year the average residuals from a regression of log population density in a given district-year on district and year fixed effects for two groups of modern Turkish districts: Those where the sum of historical population shares of Armenians and Greeks (i.e. minority share) is above the 75th percentile of the corresponding cross-district distribution, and those where it is below the 25th percentile. The short-term effect of expulsions is more visible when district and year specific factors are accounted for: high-minority regions were on average less densely populated in the 1930s, but there was a fast catch-up over the next two decades. Starting with the 1960s, the part of population density in high-minority districts that is unexplained by district and year fixed effects visibly diverges from that in low-minority districts. This is consistent with the idea that minority legacy has a time-varying component, and its positive effect has become more visible over the years.

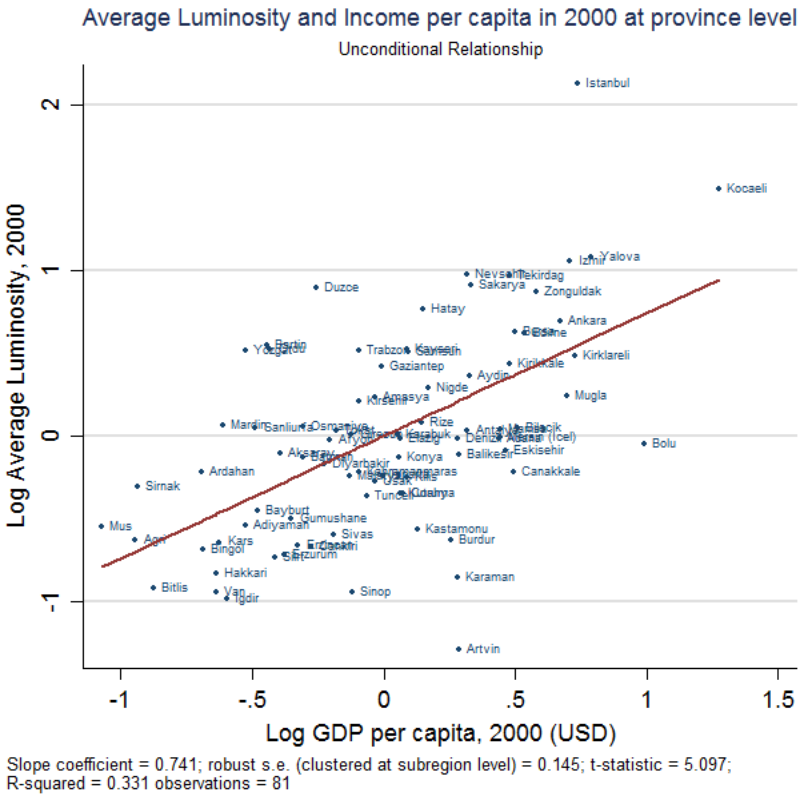

FIGURE C.4: The relationship between province income and luminosity

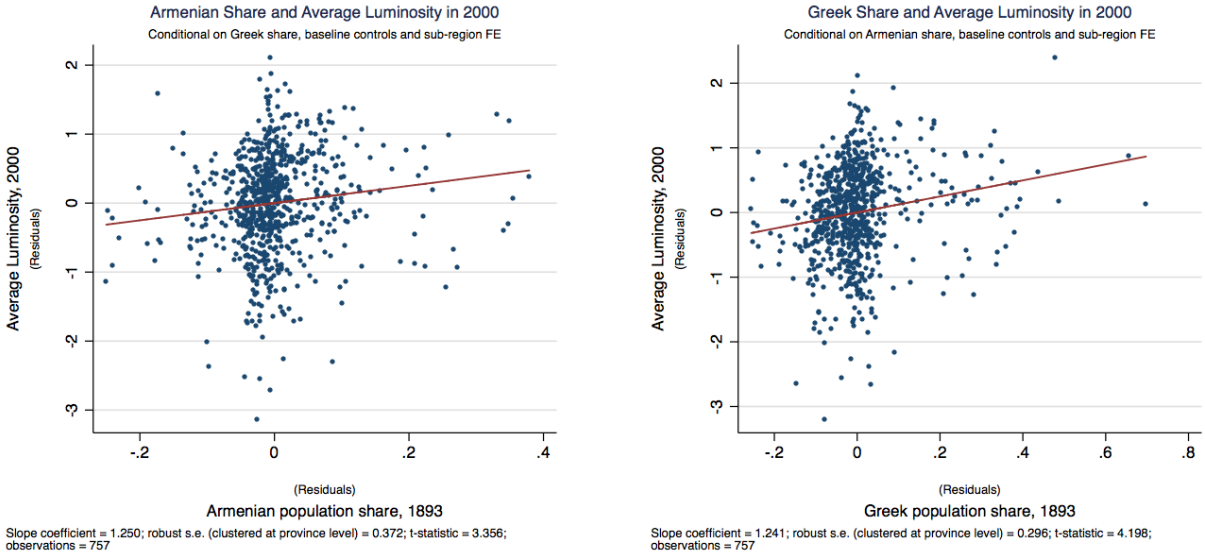

FIGURE C.5: Historical minority shares and Average Luminosity in 2000

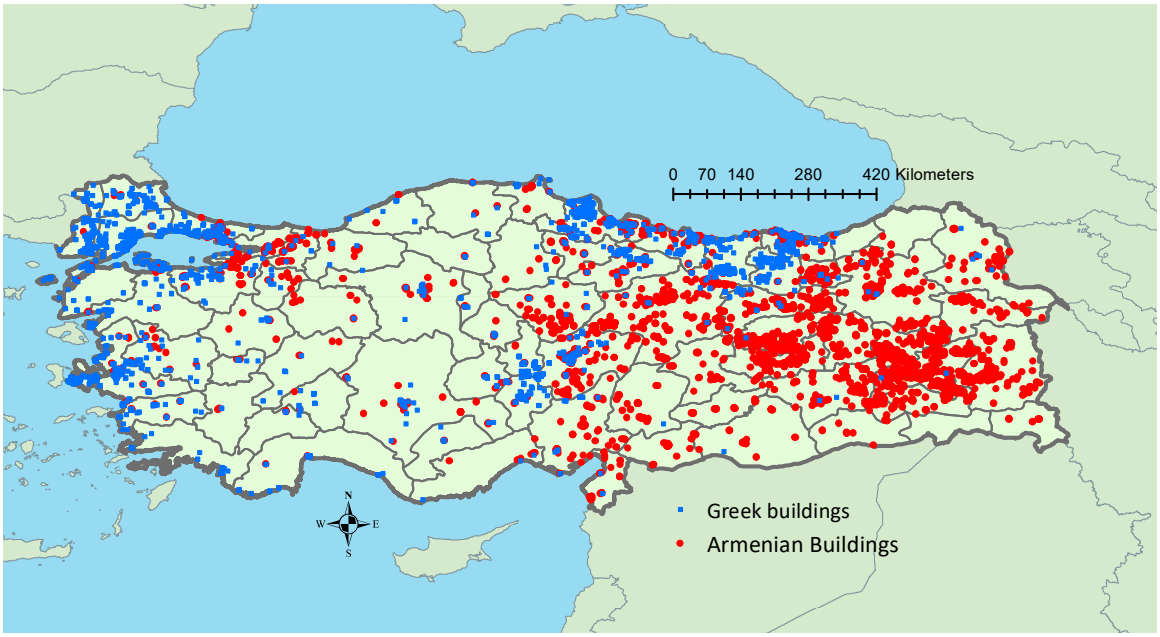

FIGURE C.6: Distribution of Old Community Buildings in Turkey

Table C.1: Summary statistics for variables used in district-level analysis

Variable	Obs.	Mean	Std.	Min	Max	Percentile 10th	Percentile 90th
Outcomes							
Log population density, 1881-1893	757	2.58	0.99	-0.37	6.02	1.38	3.67
Log population density, 1927	757	3.04	0.68	0.14	5.21	2.24	3.77
Log population density, 2000	757	4.11	1.06	1.71	9.34	2.97	5.39
Urbanization rate, 2000	757	0.46	0.20	0.09	1.00	0.22	0.75
Log(0.01+Average Luminosity, 2000)	757	0.76	1.05	-3.43	4.00	-0.55	1.98
Log(0.01+Average Luminosity, 2007-2013)	757	1.11	0.99	-2.83	4.07	-0.06	2.34
Literacy rate, 1927	757	0.07	0.06	0.01	0.32	0.02	0.12
High school competion rate, 2000	757	0.16	0.07	0.05	0.54	0.09	0.25
Land Concentration, 1997	751	0.46	0.11	0.02	0.95	0.34	0.60
Variables of interest							
Armenian population share, 1881-1893	757	0.06	0.11	0.00	0.65	0.00	0.20
Greek population share, 1881-1893	757	0.09	0.14	0.00	0.93	0.00	0.26
# Armenian school buildings per Muslim in 1893 (x1000)	757	0.03	0.08	0.00	0.88	0.00	0.07
# Greek school buildings per Muslim in 1893 (x1000)	757	0.17	3.24	0.00	88.89	0.00	0.09
# Armenian community buildings per 1935 population (x1000)	757	0.08	0.25	0.00	2.97	0.00	0.18
# Greek community buildings per 1935 population (x1000)	757	0.15	0.82	0.00	15.06	0.00	0.21
Geographical controls							
Longitude	757	33.40	4.38	25.91	44.17	27.70	39.66
Latitude	757	39.31	1.48	36.08	42.02	37.34	41.16
Mean elevation	757	0.90	0.50	0.00	2.55	0.21	1.51
Standard deviation of elevation	757	0.26	0.15	0.01	0.95	0.09	0.44
Lake	757	0.29	0.45	0.00	1.00	0.00	1.00
Sea	757	0.22	0.41	0.00	1.00	0.00	1.00
Major river	757	0.28	0.45	0.00	1.00	0.00	1.00
Average annual temperature	757	0.01	0.00	0.01	0.02	0.01	0.02
Average annual precipitation	757	0.64	0.20	0.33	1.73	0.44	0.88
Suitability to cultivation of the crop with greatest potential	757	4.19	1.66	0.24	9.34	2.04	6.44
Robustness and other controls							
Log Distance to Railroad in 1910	757	10.93	1.55	3.98	12.99	8.86	12.63
Log Distance to Major 19th century port	757	5.03	0.80	0.00	6.24	4.11	5.74
Log Distance (km) to war front, 1919-1922	757	4.15	1.28	-0.99	5.85	2.43	5.53
Log WW1 soldier casualty from province	757	7.07	1.02	1.39	8.37	5.99	8.22
Share of Kurdish speakers in 1927 province	757	7.55	18.35	0.00	88.94	0.02	41.81
Share of immigrants (1921-1929) in 1927 province	757	0.04	0.07	0.00	0.60	0.00	0.09
Share of 1927 population born in Albania	757	0.00	0.00	0.00	0.00	0.00	0.00
Share of 1927 population born in Greece	757	0.01	0.02	0.00	0.36	0.00	0.01
Share of 1927 population born in Romania	757	0.00	0.00	0.00	0.07	0.00	0.00
Share of other 1927 population born outside Turkey	757	0.02	0.06	0.00	0.64	0.00	0.06
Central kaza/sancak	757	0.42	0.49	0.00	1.00	0.00	1.00
Log Distance to Istanbul	757	6.04	0.67	3.52	7.19	5.11	6.84
Log Distance to nearest national border	757	5.19	0.87	1.66	6.27	4.00	6.07
Log Distance to Ottoman Trade Routes	757	10.28	0.91	7.15	11.95	9.01	11.40
Log Distance to Anatolian Silk Road	757	10.10	0.88	7.30	11.77	8.88	11.23
Any settlement from Neolithic period?	757	0.19	0.39	0.00	1.00	0.00	1.00
Any ancient Greek site?	757	0.17	0.37	0.00	1.00	0.00	1.00
Log Distance to Tushpa (Van)	757	6.66	0.63	0.76	7.32	5.94	7.22
Population share of age<13 in 1927	757	0.33	0.04	0.23	0.44	0.28	0.38
Female-male ratio in 1927	757	1.11	0.14	0.64	1.55	0.94	1.25

Table C.2: Summary statistics for variables used in village/neighborhood-level analysis

Variable	Obs.	Mean	Std.	Min	Max	Percentile 10th	Percentile 90th
Outcome variable							
Log Average Luminosity (in 2000) within 5km radius of village/neighborhood	49321	0.49	2.25	-4.61	4.14	-3.30	2.88
Variables of interest							
Armenian community building within 5km	49321	0.22	0.42	0.00	1.00	0.00	1.00
Greek community building within 5km	49321	0.16	0.37	0.00	1.00	0.00	1.00
Armenian school building within 5km	49321	0.14	0.34	0.00	1.00	0.00	1.00
Greek school building within 5km	49321	0.09	0.29	0.00	1.00	0.00	0.00
Log(1+# of Armenian non-school community buildings within 5km)	49321	0.27	0.60	0.00	3.87	0.00	1.10
Log(1+# of Armenian non-school community buildings within 5km)	49321	0.22	0.63	0.00	4.64	0.00	0.69
Geographical controls							
Log distance to nearest major river	49321	9.89	1.24	0.04	12.02	8.18	11.18
Log distance to sea coast	49321	11.11	1.52	0.91	13.22	9.03	12.54
Log distance to lake	49321	9.93	1.08	0.00	11.95	8.70	11.04
Log altitude	49321	4.78	2.96	0.00	13.70	0.00	7.36
Longitude	49321	34.92	4.79	26.07	44.76	28.15	41.47
Latitude	49321	39.25	1.49	35.86	42.09	37.14	41.12
Other controls							
Ottoman city within 15km	49321	0.34	0.47	0.00	1.00	0.00	1.00
Log distance to Ottoman Trade routes (circa 1300-1600 CE)	49321	10.06	1.35	0.74	12.32	8.24	11.42
Log distance to Anatolian Silk Road (circa 1200-1400 CE)	49321	9.65	1.50	0.13	11.98	7.55	11.21
Log distance to nearest modern province center	49321	10.31	1.02	0.00	11.86	9.10	11.21
Log distance to Istanbul	49321	13.17	0.69	10.58	14.21	12.17	13.95
Log distance to Izmir	49321	13.27	0.88	6.49	14.31	12.13	14.09
Log distance to Ankara	49321	12.84	0.69	6.72	13.94	12.07	13.59
Log distance to Bursa	49321	13.06	0.84	5.55	14.20	12.00	13.94
Log distance to modern railroad network	49321	9.91	1.50	0.87	12.10	7.68	11.46
Village dummy	49321	0.37	0.48	0.00	1.00	0.00	1.00

Table C.3: Historical Minority Shares and Population Densities in 1927 and 2000

PANEL A	Log(Population density in 1927)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Armenian population share, 1881-1893	-0.929	-0.746	-0.983	-0.719	-0.744	-0.712	-0.713	-0.739***	-0.566*
	[0.653]	[0.699]	[0.648]	[0.534]	[0.533]	[0.529]	[0.531]	[0.273]	[0.298]
Greek population share, 1881-1893	0.195	-0.344*	-0.348*	-0.548***	-0.530***	-0.500***	-0.505***	-0.517***	-0.522**
	[0.346]	[0.175]	[0.189]	[0.165]	[0.177]	[0.178]	[0.187]	[0.188]	[0.225]
Proxy for population density in 1893	0.283*	0.211	0.203	0.199	0.199	0.197	0.196	0.487***	0.439***
	[0.157]	[0.146]	[0.138]	[0.122]	[0.123]	[0.121]	[0.121]	[0.142]	[0.162]
Effect of increasing Armenian share	-18.431	-14.814	-19.510	-14.276	-14.758	-14.132	-14.155	-14.669***	-11.242*
from the 10-th to the 90-th percentile	[12.951]	[13.864]	[12.870]	[10.591]	[10.574]	[10.493]	[10.532]	[5.422]	[5.920]
Effect of increasing Greek share	6.337	-11.211**	-11.325*	-17.838***	-17.243***	-16.287***	-16.441***	-16.826***	-16.997**
from the 10-th to the 90-th percentile	[11.259]	[5.694]	[6.160]	[5.362]	[5.747]	[5.793]	[6.080]	[6.126]	[7.329]
Observations	309	309	309	309	309	309	309	309	309
Adjusted R-squared	0.246	0.366	0.378	0.461	0.458	0.457	0.455	0.610	0.626

PANEL B	Log(Population density in 2000)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Armenian population share, 1881-1893	1.393***	1.395**	1.481***	1.588***	1.615***	1.524***	1.518***	1.185***	1.024**
	[0.451]	[0.532]	[0.423]	[0.460]	[0.392]	[0.409]	[0.380]	[0.373]	[0.454]
Greek population share, 1881-1893	0.970***	1.325***	1.390***	0.950***	0.712***	0.714***	0.931***	0.816**	0.466
	[0.340]	[0.318]	[0.322]	[0.264]	[0.263]	[0.269]	[0.282]	[0.317]	[0.295]
Log(Population density, 1927)	0.826***	0.918***	0.945***	0.765***	0.756***	0.765***	0.775***	0.814***	0.806***
	[0.098]	[0.103]	[0.096]	[0.105]	[0.096]	[0.092]	[0.095]	[0.090]	[0.110]
Effect of increasing Armenian share	27.637***	27.686***	29.398***	31.521***	32.053***	30.256***	30.129***	23.524***	20.326**
from the 10-th to the 90-th percentile	[8.953]	[10.560]	[8.391]	[9.128]	[7.788]	[8.120]	[7.549]	[7.395]	[9.008]
Effect of increasing Greek share	24.946***	34.053***	35.743***	24.427***	18.309***	18.359***	23.937***	20.973***	11.986
from the 10-th to the 90-th percentile	[8.751]	[8.185]	[8.283]	[6.798]	[6.756]	[6.905]	[7.243]	[8.141]	[7.595]
Observations	757	757	757	757	757	757	757	757	757
Adjusted R-squared	0.304	0.325	0.332	0.421	0.440	0.441	0.454	0.480	0.521
Longitude & Latitude			×	×	×	×	×	×	×
Mean & std. of elevation				×	×	×	×	×	×
Lake, sea and major rivers					×	×	×	×	×
Temperature & Precipitation						×	×	×	×
Suitability to cultivation							×	×	×
Modern region dummies		×	×	×	×	×	×		
Modern subregion dummies								×	
Modern province dummies									×

Notes: This table presents results from the regressions of Log Population Density in 1927 and Log Population Density in 2000 on historical minority shares controlling for past population density, geographic variables, region, subregion or province fixed effects. The estimated effect associated with increasing minority shares from the tenth to the ninetieth percentile of their respective cross-district distributions is expressed in terms of % change in the level of population density. Robust standard errors, clustered at the modern Turkish province (*il*) level, are reported in square brackets. *** denotes statistical significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level.

Table C.4: Historical Minority Shares and Urbanization Rates in 2000

	Urbanization rate in 2000								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Armenian population share, 1881-1893	0.252***	0.269***	0.344***	0.345***	0.355***	0.392***	0.391***	0.466***	0.486***
	[0.095]	[0.089]	[0.094]	[0.091]	[0.090]	[0.086]	[0.083]	[0.091]	[0.096]
Greek population share, 1881-1893	0.136**	0.205***	0.208***	0.177***	0.174***	0.168***	0.206***	0.194***	0.265***
	[0.061]	[0.066]	[0.063]	[0.065]	[0.065]	[0.063]	[0.064]	[0.061]	[0.074]
Log(Population density, 1927)	0.064***	0.096***	0.099***	0.088***	0.087***	0.084***	0.085***	0.093***	0.105***
	[0.020]	[0.020]	[0.019]	[0.020]	[0.020]	[0.020]	[0.020]	[0.022]	[0.022]
Effect of increasing Armenian share	5.002***	5.346***	6.827***	6.853***	7.040***	7.781***	7.759***	9.257***	9.651***
from the 10-th to the 90-th percentile	[1.883]	[1.761]	[1.870]	[1.800]	[1.782]	[1.701]	[1.656]	[1.812]	[1.899]
Effect of increasing Greek share	3.507**	5.259***	5.342***	4.561***	4.481***	4.325***	5.292***	4.980***	6.801***
from the 10-th to the 90-th percentile	[1.556]	[1.697]	[1.626]	[1.680]	[1.678]	[1.609]	[1.651]	[1.574]	[1.907]
Observations	757	757	757	757	757	757	757	757	757
Adjusted R-squared	0.062	0.102	0.107	0.117	0.118	0.125	0.136	0.151	0.205
Longitude & Latitude			×	×	×	×	×	×	×
Mean & std. of elevation				×	×	×	×	×	×
Lake, sea and major rivers					×	×	×	×	×
Temperature & Precipitation						×	×	×	×
Suitability to cultivation							×	×	×
Modern region dummies		×	×	×	×	×	×		
Modern subregion dummies								×	
Modern province dummies									×

Notes: This table presents results from the regressions of Urbanization Rate in 2000 on historical minority shares controlling for past population density, geographic variables, region, subregion or province fixed effects. The estimated effect associated with increasing minority shares from the tenth to the ninetieth percentile of their respective cross-district distributions is expressed in terms of percentage-point change in the urbanization rates. Robust standard errors, clustered at the modern Turkish province (*il*) level, are reported in square brackets. *** denotes statistical significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level.

Table C.5: Robustness of Main Results to Using Estimated Minority Shares for Incomplete Census Districts

	(1)	(2)	(3)
	Population Density	Urbanization	Luminosity
	OLS	OLS	OLS
Estimated Armenian share, 1881-1893	1.040***	0.438***	0.945**
	[0.353]	[0.097]	[0.394]
Estimated Greek share, 1881-1893	0.900***	0.186***	1.256***
	[0.299]	[0.060]	[0.274]
Log(Population density, 1927)	0.681***	0.070***	0.561***
	[0.094]	[0.021]	[0.086]
Observations	859	859	859
Baseline controls	Yes	Yes	Yes
Modern subregion dummies	Yes	Yes	Yes
Adjusted R-squared	0.471	0.115	0.488

Notes: This table presents results from the regressions of Log Population Density in 2000, Urbanization Rate in 2000, and Log Average Luminosity in 2000 on estimated historical minority shares for incomplete census regions, controlling for past population density, geographical variables, and subregion fixed effects. Robust standard errors, clustered at the modern Turkish province (*il*) level, are reported in parentheses. *** denotes statistical significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level.

Table C.6: Oster (2017) coefficient stability analysis

Full Model:	(1) **Baseline specification (column 8 of Table 1)**	(2) **All controls (column 5 of Table 3)**
	R_{max}**=0.69**	R_{max} **= 0.82**
δ (Armenian share)	-10.38	2.66
δ (Greek share)	2.67	0.79

Notes: This table applies Oster (2017) technique to assess how strong the correlation between the unobservables and our main variables of interest (Armenian and Greek shares in the late 19th century Ottoman Empire), relative to the correlation of the observables with the same variables of interest, has to be in order to explain away the estimated relationships in the full models considered. δ statistic captures this relative selection ratio. All calculations have been performed using the software *psacalc* provided by the author. In Column (1), the full model corresponds to column 8 in Table 1. In Column (2), the full model corresponds to column 5 in Table 3. Restricted model contains only subregion FE and no other control variables. R_{max} is the maximum R-squared that could be attained if all the relevant controls would be introduced in the regression. Following the advice in Oster (2017), we set R_{max} equal to 1.3 times the value of the R^2 obtained from the full model, which in our case equals 0.69 in column (1) and 0.82 in column (2). See the main text and Oster (2017) for details.

Table C.7: Mean Difference Tests for Treated and Control Districts

Panel A: Armenian Treatment	**Mean Treated**	**Mean Control**	**Mean Difference**	**P-Value**
Longitude	33.46	33.32	-0.14	0.66
Latitude	39.39	39.24	-0.15	0.17
Average Elevation	912.62	891.55	-21.07	0.56
Std. Elevation	241.69	270.04	28.35**	0.01
Lake	0.30	0.28	-0.02	0.57
Sea	0.20	0.23	0.02	0.48
Major Rivers	0.26	0.30	0.04	0.23
Temperature	0.01	0.01	0.00	0.11
Precipitation	0.63	0.66	0.03*	0.07
Suitability to Cultivation	4.26	4.12	-0.14	0.24
N	758	758	758	758

Panel B: Greek Treatment	**Mean Treated**	**Mean Control**	**Mean Difference**	**P-Value**
Longitude	34.42	32.38	-2.04***	0.00
Latitude	39.06	39.56	0.50***	0.00
Average Elevation	950.71	853.84	-96.87**	0.01
Std. Elevation	252.82	259.38	6.56	0.54
Lake	0.33	0.25	-0.08**	0.01
Sea	0.25	0.18	-0.07**	0.02
Major Rivers	0.26	0.31	0.06*	0.09
Temperature	0.01	0.01	-0.00**	0.04
Precipitation	0.61	0.68	0.07***	0.00
Suitability to Cultivation	4.13	4.24	0.12	0.33
N	758	758	758	758

Panel C: Greek Treatment (Trimmed)	**Mean Treated**	**Mean Control**	**Mean Difference**	**P-Value**
Longitude	32.72	32.59	-0.13	0.68
Latitude	39.29	39.52	0.23*	0.06
Average Elevation	885.06	913.28	28.23	0.47
Std. Elevation	251.44	252.05	0.61	0.96
Lake	0.28	0.26	-0.03	0.47
Sea	0.31	0.19	-0.12***	0.00
Major Rivers	0.24	0.28	0.04	0.32
Temperature	0.01	0.01	-0.00	0.10
Precipitation	0.63	0.64	0.02	0.33
Suitability to Cultivation	4.24	4.32	0.08	0.54
N	602	602	602	602

Notes: This table reports mean difference tests for exogenous covariates by minority treatment indicators. Minority treatment indicators are set to one for districts with above median minority shares after having filtered out the subregion fixed effects. Panel A reports mean difference tests by Armenian Treatment Indicator. Panel B reports mean difference tests by Greek Treatment indicator. Panel C reports mean difference tests by Greek Treatment indicator after having trimmed the sample to the [0.2, 0.8] interval of the propensity score. *** denotes statistical significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level.

Table C.8: Minority Presence and Average Luminosity, Matching Estimates: Robustness of the results in Table 4 to alternative propensity score matching methods

	(1)	(2)	(3)	(4)	(5)
	Propensity Score Matching				
	Nearest Neighbour (Equal Weights)	Radius (r=0.1)	Gaussian Kernel	Epanechnikov Kernel (bw=0.06)	Epanechnikov Kernel (bw=0.04)
	Panel A: Armenian Treatment Estimates (Dep.Var.: Log Average Luminosity in 2000)				
Armenian Treatment	0.239	0.274	0.264	0.255	0.26
Armenian Treatment (Bias Adjusted)	0.215	0.273	0.259	0.256	0.235
Bootstrapped Standard Errors	[0.106]**	[0.076]***	[0.083]***	[0.067]***	[0.067]***
Analytical Standard Errors	(0.100)**	(0.078)***	-	-	-
Treatment Districts	372	372	372	372	372
Control Districts	201	379	379	379	379
Common Support	Yes	Yes	Yes	Yes	Yes
Balancing Property Satisfied	Yes	Yes	Yes	Yes	Yes
Observations	573	751	751	751	751
	Panel B: Greek Treatment Estimates (Dep.Var.: Log Average Luminosity in 2000)				
Greek Treatment	0.342	0.43	0.37	0.349	0.353
Greek Treatment (Bias Adjusted)	0.368	0.418	0.386	0.341	0.348
Bootstrapped Standard Errors	[0.100]***	[0.080]***	[0.091]***	[0.081]***	[0.083]***
Analytical Standard Errors	(0.110)***	(0.086)***	-	-	-
Treatment Districts	279	279	279	279	279
Control Districts	152	322	322	322	322
Common Support	Yes	Yes	Yes	Yes	Yes
Balancing Property Satisfied	Yes	Yes	Yes	Yes	Yes
Observations	431	601	601	601	601

Notes: This table presents the propensity score matching estimates of the average treatment effect of the Armenian and Greek treated districts (ATT), in Panels A and B respectively. Armenian and Greek Treatment indicators are equal to one for above median shares of respective distributions after having filtered out subregion fixed effects. Subregion fixed effects are also filtered out of the dependent variable, luminosity. The baseline exogenous variables that are used in the matching procedure are longitude, latitude, elevation, standard deviation of elevation, lake, sea, river dummies, temperature, precipitation, and suitability to cultivation. To ensure that balancing property is satisfied, we trim the sample for the Greek treatment to the propensity score interval of [0.2,0.8]. We show two sets of ATT estimates that are either uncorrected or corrected for small sample bias due to non-exact matches. Nearest neighbor matching with equal weights is applied in column (1). The Epanechnikov kernel is applied in columns (4) (bandwidth=0.06) and (5) (bandwidth=0.04). Bootstrapped standard errors (1000 replications) are given in brackets, while analytical standard errors are given in parentheses. *** denotes statistical significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level.

Table C.9: Minority Presence and Average Luminosity: Further robustness checks for matching estimates, Robustness to alternative treatment definitions

Panel A: Robustness to alternative treatment definitions **Treatment = 1 if minority share is above the sample median of the raw data**	(1)	(2)	(3)	(4)	(5)	(6)	(7)
			Covariate Matching	Propensity Score Matching			
	OLS	OLS	Nearest Neighbour	Nearest Neighbour	Radius (r=0.05)	Kernel (bw=0.02)	Stratification
				Armenian Treatment Estimates			
Armenian Treatment	0.358	0.338	0.299	0.219	0.312	0.293	0.29
Armenian Treatment (Bias Adjusted)			0.232	0.179	0.307	0.278	0.28
Bootstrapped Standard Errors	[0.116]***	[0.110]***	-	[0.115]*	[0.088]***	[0.089]***	[0.086]***
Analytical Standard Errors	(0.112)***	(0.107)***	(0.097)***	(0.109)**	(0.086)***	-	-
Treatment Districts			313	313	313	313	313
Control Districts			290	161	290	290	290
Common Support	No	Yes	Yes	Yes	Yes	Yes	Yes
Balancing Property Satisfied	-	-	-	Yes	Yes	Yes	Yes
Observations	758	603	603	474	603	603	603
				Greek Treatment Estimates			
Greek Treatment	0.482	0.552	0.44	0.582	0.565	0.539	0.567
Greek Treatment (Bias Adjusted)			0.44	0.598	0.574	0.55	0.56
Bootstrapped Standard Errors	[0.107]***	[0.136]***		[0.172]***	[0.108]***	[0.141]***	[0.119]***
Analytical Standard Errors	(0.107)***	(0.139)***	(0.135)***	(0.147)***	(0.110)***	-	(0.116)***
Treatment Districts			154	154	153	154	154
Control Districts			153	83	153	153	153
Common Support	No	Yes	Yes	Yes	Yes	Yes	Yes
Balancing Property Satisfied	-	-	-	Yes	Yes	Yes	Yes
Observations	758	307	307	237	306	307	307

Panel B: Robustness to alternative treatment definitions **Treatment = 1 if minority share is above 1%**	(1)	(2)	(3)	(4)	(5)	(6)	(7)
			Covariate Matching	Propensity Score Matching			
	OLS	OLS	Nearest Neighbour	Nearest Neighbour	Radius (r=0.05)	Kernel (bw=0.02)	Stratification
				Armenian Treatment Estimates			
Armenian Treatment	0.269	0.27	0.189	0.202	0.279	0.202	0.236
Armenian Treatment (Bias Adjusted)			0.149	0.191	0.28	0.201	0.236
Bootstrapped Standard Errors	[0.110]**	[0.107]**		[0.094]**	[0.080]***	[0.079]***	[0.086]***
Analytical Standard Errors	(0.108)**	(0.108)**	(0.089)*	(0.109)*	(0.083)***	-	(0.084)***
Treatment Districts			477	477	477	477	477
Control Districts			275	175	275	275	275
Common Support	No	Yes	Yes	Yes	Yes	Yes	Yes
Balancing Property Satisfied	-	-	-	Yes	Yes	Yes	Yes
Observations	758	752	752	652	752	752	752
				Greek Treatment Estimates			
Greek Treatment	0.429	0.393	0.317	0.444	0.496	0.488	0.509
Greek Treatment (Bias Adjusted)			0.36	0.415	0.497	0.489	0.506
Bootstrapped Standard Errors	[0.099]***	[0.116]***		[0.174]**	[0.118]***	[0.145]***	[0.139]***
Analytical Standard Errors	(0.096)***	(0.117)***	(0.137)**	(0.150)***	(0.117)***	-	-
Treatment Districts			185	185	184	185	184
Control Districts			145	89	144	145	146
Common Support	No	Yes	Yes	Yes	Yes	Yes	Yes
Balancing Property Satisfied	-	-	-	Yes	Yes	Yes	Yes
Observations	758	330	330	274	328	330	330

Notes: This table presents the covariate and propensity score matching estimates of the average treatment effect of the Armenian and Greek treated districts (ATT). In Panel A, Armenian and Greek Treatment indicators are equal to one for above median shares of respective distributions of the raw data. In Panel B, Armenian and Greek Treatment indicators are equal to one for above 1% shares of respective distributions of the raw data. The baseline exogenous variables that are used in the matching procedure are longitude, latitude, elevation, standard deviation of elevation, lake, sea, river dummies, temperature, precipitation, and suitability to cultivation. To ensure that balancing property is satisfied, we trim the sample for the Armenian treatment to the propensity score interval of [0.3,0.7] in Panel A, and for the Greek treatment to the propensity score interval of [0.4,0.6] in Panel A and to [0.3,0.7] in Panel B. We show two sets of ATT estimates that are either uncorrected or corrected for small sample bias due to non-exact matches. Nearest neighbor matching with random draw is applied in column (4). The Epanechnikov kernel (bandwidth=0.02) is applied in column (6). Bootstrapped standard errors (1000 replications) are given in brackets, while analytical standard errors are given in parentheses (both type of standard errors are clustered at the province level for OLS). *** denotes statistical significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level.

Table C.10: Minority Presence and Average Luminosity, Matching Estimates: Robustness to matching on additional variables

	(1)	(2)	(3)	(4)	(5)
	Propensity Score Matching (Radius Matching with r=0.05)				
	Panel A: Armenian Treatment Estimates (Dep.Var.: Log Average Luminosity in 2000)				
Armenian Treatment	0.323	0.321	0.266	0.314	0.308
Armenian Treatment (Bias Adjusted)	0.320	0.321	0.266	0.315	0.321
Bootstrapped Standard Errors	[0.072]***	[0.070]***	[0.070]***	[0.071]***	[0.078]***
Analytical Standard Errors	(0.071)***	(0.072)***	(0.072)***	(0.072)***	(0.072)***
Treatment Districts	372	372	348	372	366
Control Districts	380	378	351	380	385
Common Support	Yes	Yes	Yes	Yes	Yes
Balancing Property Satisfied	Yes	Yes	Yes	Yes	Yes
Baseline Exogenous Variables	Yes	Yes	Yes	Yes	Yes
Observations	752	750	699	752	751
Additional Matching Variable	Population Density in 1893	Distance to Istanbul	Distances to Railroad in 1910 & Major 19th century port	Distances to Anatolian Silk Road & to Ottoman Trade Routes	All of the previous
	Panel B: Greek Treatment Estimates (Dep.Var.: Log Average Luminosity in 2000)				
Greek Treatment	0.493	0.504	0.450	0.446	0.367
Greek Treatment (Bias Adjusted)	0.492	0.506	0.462	0.452	0.371
Bootstrapped Standard Errors	[0.080]***	[0.075]***	[0.076]***	[0.080]***	[0.078]***
Analytical Standard Errors	(0.082)***	(0.079)***	(0.080)***	(0.078)***	(0.080)***
Treatment Districts	250	277	274	280	241
Control Districts	305	325	312	319	308
Common Support	Yes	Yes	Yes	Yes	Yes
Balancing Property Satisfied	Yes	Yes	Yes	Yes	Yes
Baseline Exogenous Variables	Yes	Yes	Yes	Yes	Yes
Observations	555	602	699	599	549
Additional Matching Variable	Population Density in 1893	Distance to Istanbul	Distances to Railroad in 1910 & Major 19th century port	Distances to Anatolian Silk Road & to Ottoman Trade Routes	All of the previous

Notes: This table presents the robustness of the propensity score matching estimates of the average treatment effect of the Armenian and Greek treated districts (ATT) to matching on additional variables, in Panels A and B respectively. Armenian and Greek Treatment indicators are equal to one for above median shares of respective distributions after having filtered out subregion fixed effects. Subregion fixed effects are also filtered out of the dependent variable, luminosity. The baseline exogenous variables that are used in every column for the matching procedure are longitude, latitude, elevation, standard deviation of elevation, lake, sea, river dummies, temperature, precipitation, and suitability to cultivation. Additional variables on which we match are highlighted in row "Additional Matching Variable." To ensure that balancing property is satisfied, we trim the sample for the Armenian treatment to the propensity score interval of [0.25,0.75] in columns (1), and (3). To ensure that balancing property is satisfied, we trim the sample for the Greek treatment to the propensity score interval of [0.2,0.8] in columns (1), (2), (3), (4), and (5). We show two sets of ATT estimates that are either uncorrected or corrected for small sample bias due to non-exact matches. Bootstrapped standard errors (1000 replications) are given in brackets, while analytical standard errors are given in parentheses. *** denotes statistical significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level.