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Human capital transfers and sub-national development: Armenian and Greek legacy in post-expulsion Turkey

Cemal Eren Arbatlı[1] · **Gunes Gokmen**[2]

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Abstract
Can the economic legacy of highly skilled groups persist long after they were uprooted from their homelands? To answer this question, we study long-term sub-national development in Turkey after the mass expulsions of the Armenian and Greek communities of the Ottoman Empire in the early 20th century. Since these events led to an almost complete and permanent removal of both communities from Turkey within a short time period, they provide a unique quasi-natural experiment that rules out any direct minority influence on development in the post-expulsion period. By exploiting local variations in historical minority population shares and community buildings across modern districts and villages/neighborhoods within each district, we document a sizable Armenian and Greek legacy effect on contemporary measures of economic development. We argue that this persistent influence is grounded on the significant contribution of Armenian and Greek communities to human capital accumulation among Muslims. We show evidence that inter-group transfers of skills and knowledge were instrumental in this process, leading to greater human capital among Muslims in minority regions both in the past and today.

Keywords Human capital · Human capital transfers · Economic development · Expulsion · Minorities · Ethnicity · Armenians · Greeks · Legacy · Persistence

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Extended author information available on the last page of the article

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1 Introduction

History abounds with episodes of forced migration triggered by civil unrest, wars, natural disasters, and state mandated expulsions or relocations. If current times are any indication, we will continue to witness similar events going forward.

Forced migration may yield qualitatively different consequences for stayers, migrants, and destination regions. Yet, the literature so far has largely focused on the impact of forced migration on receiving populations (e.g., Hornung, (2014)) or migrants themselves (e.g., Becker et al., (2020)), while paying less attention to the long-term prosperity of sending regions.[1]

How sending regions fare in the long run depends on both the adverse effects of forced out-migrations and how departing populations had shaped the development potential of local economies until they left. These latter effects—the economic legacy of émigrés—may operate through human capital spillovers from departing groups onto the staying population and the productive assets these groups accumulated until departure. Ultimately, the characteristics of departing groups (e.g. education, occupational skills, tangible assets relative to stayers) and the nature of social and economic interactions between departing and staying groups will dictate the economic legacy of émigrés. However, disentangling the legacy of departing groups from the contemporaneous influence of their remaining members and the potential endogeneity of migration is a challenge.

We examine the economic footprints of the two largest non-Muslim communities in the Ottoman Empire, i.e. Armenians and Greeks, almost a century after their wholesale removal from their homelands within modern Turkey. Our goal is to study whether the positive legacy effects of these high-skilled groups are sufficiently strong –against the backdrop of the potentially adverse impact of the expulsions themselves– so as to impart a lasting imprint on spatial patterns of economic development. This is a novel departure from the literature examining the lasting impact of human capital and the cultural and institutional heritage migrant communities bring *to the locations they settle*. This paper, instead, studies the legacy of these groups on the subsequent economic development *of the locations they departed*.

Armenian and Greek communities of Anatolia historically possessed higher levels of human capital and wealth relative to Muslim groups (Üngör & Polatel, 2011; Der Matossian, 2007; Kévorkian, 2011). Particularly over the 18th and 19th centuries, when trade between the Middle East and Western Europe was soaring, the economic standing of the non-Muslim minorities of the Empire significantly improved vis-a-vis the Muslim communities as the former came to dominate trade and commerce (Kuran, 2004). Two events at the turn of the 20th century marked the end of centuries-long religious coexistence. Ottoman 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 tragic episodes provide us with two unique experiments of history that are well suited to empirically assess the long-run legacy

[1] Becker and Ferrara (2019) offer a comprehensive overview of the literature.

of productive minorities on regional development, in general, and on local human capital, in particular.

Measuring the economic legacy of departing groups is challenging. Regional differences in the timing of outmigration, the possibility of return migration, and the role of economic choices pose difficulties. Our historical setting is largely immune to these problems. Both Greeks and Armenians were forced to leave their homelands as a result of the official state policies that were motivated by the ongoing wars and the ideological orientation 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.[2]

The timing of expulsions almost a century ago allows us a reasonably long window of time to assess the persistence of minority legacy. Therefore, we 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.[3]

We find 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 light density at night. Estimates suggest 11 and 14 percent higher income per capita in response to a move from the 10th to the 90th percentile of the Armenian and Greek population share distributions, respectively. A rich battery of robustness checks and complementary evidence at a more granular geographic level suggest that the relationships we document likely reflect a causal minority legacy.

First, our baseline results are robust to potential geographic and climatic determinants of early economic activity that might have influenced historical settlement patterns. Also, our estimates are not sensitive to various drivers of historical and contemporary development. For example, 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, and (iv) density of neolithic sites and ancient settlements as a proxy for prehistoric conditions favorable to agriculture and amenable to permanent settlement. To more flexibly account for selection on observables, we employ matching estimators and find results that are qualitatively similar to the OLS analysis. We also verify that selection on unobservables is unlikely to explain away our estimates (Altonji et al., 2005; Oster, 2019). Lastly, we verify that spatial correlation does not drive our results.[4]

Second, we zoom into the level of villages and neighborhoods in Turkey to offer micro-level evidence. We find that nighttime light density today is remarkably higher in localities with Armenian and Greek community buildings –a proxy for historical minority presence in the absence of demographic data at a granular level. Estimates remain significant and sizable accounting for likely confounders and district level fixed effects. Importantly, accounting for district fixed effects brings us closer to a causal interpretation as we exploit variation across very close localities that are highly similar

[2] With the exception of Istanbul, none of the provinces in modern-day Turkey was spared from the expulsions and only a negligible number of survivors could return.

[3] Unlike Greeks and Armenians, the Ottoman Jews did not experience a systematic and large scale expulsion. Thus, our analysis is confined to Armenian and Greek legacy. Besides, Jewish population shares and their geographical variation were too small to conduct a meaningful statistical analysis.

[4] Nevertheless, the results should be interpreted with caution, as we cannot rule out all remaining channels.

in unobserved geographic, cultural and institutional characteristics. Thus, omitted factors are very unlikely to confound the causal relationship between minority presence and luminosity. Lastly, to take into account historical agglomeration that is not driven by minority presence per se, we also account for proximity to old Muslim community buildings and find similar results.

We argue that an important source of minority legacy was inter-group human capital spillovers during the long co-existence of Muslim and non-Muslim communities. In support of this mechanism, we first 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, already before the expulsions, Muslims in high minority regions were relatively more educated than other Muslim groups. In the immediate aftermath of the mass expulsions, regions that were previously home to minorities still had higher literacy rates among remaining Muslims than low-minority regions, and a greater share of the Muslims in these regions were employed in commerce.

We then demonstrate that today there are still significant gaps in educational attainment between high and low-minority districts. Baseline estimates suggest that a 20 percent increase in either historical Armenian or Greek share implies 2.1 percentage points higher current high school completion rates. This change amounts to more than 12.5 percent of the mean completion rate of 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 even conditional on other types of community buildings.

Finally, consistently with the human capital spillover channel, we document continuity in occupational patterns. Using novel historical micro data on religious identity and occupation for the entire universe of male residents in three Anatolian cities around 1840s, we show that Armenians and Greeks were indeed over-represented in relatively more skill-intensive occupation groups, and that religious diversity within some of these occupation groups was particularly high –suggesting ample scope for inter-group economic interactions and knowledge and skill transfer. Then, drawing on the 2000 Census micro data, we confirm that many of the same occupation groups where minorities tended to specialize constitute a higher share of the labor force today in ex-minority regions.

As an additional channel of persistence, we assess the potential role of minority assets and the way they were redistributed among the Muslim population in the aftermath of the expulsions. We offer suggestive evidence that redistribution of confiscated minority assets among Muslim groups contributed to wealth concentration in the long run. In particular, 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 of "abandoned" Armenian properties were members of local Muslim elite. Greek property, instead, was relatively less subject to asset grabbing by local elite than Armenian property, and historically Greek areas received larger flows of Muslim immigrants. Accordingly, we find that modern land inequality is not related to historical Greek buildings. It is possible that concentration of land and wealth facilitated business formation particularly during the

early stages of Turkish economic development despite its adverse effects on human capital accumulation.[5]

Taken together, our findings bear significance beyond their particular context. They imply that, in regions with mass population replacements, the legacy of past population geography can be an important confounder. In particular, not only the ancestral heritage of *current* populations, but also the economic influence of long-gone groups can leave a strong imprint on spatial patterns of economic development. Therefore, when evaluating the role of ancestral origins in comparative development, one needs to better account for the history of past populations that are long gone.

1.1 Contribution to the literature

The exodus of Greeks and Armenians permanently altered the composition of embodied traits in the remaining populations. This major shock might have reduced the future economic potential of the sending regions not only vis-a-vis their own counterfactual trajectories but also vis-a-vis the other regions that were not directly affected by the expulsions. Yet, we find that regions that were treated with historical minority presence fared better in the post-expulsion period compared to areas without significant Greek or Armenian presence. Thus, our first novel contribution is to demonstrate that the positive *historical legacy* of high-skilled groups can trump any negative effect these regions might have experienced. Related literature highlights the effects of expulsions and persecutions on social structure, labor market outcomes and education (Acemoglu et al., 2011; Becker et al., 2020; Testa, 2021; Bharadwaj et al., 2015), agricultural productivity (Bazzi et al., 2016; Bharadwaj & Mirza, 2019), population dynamics (Chaney & Hornbeck, 2016), firm performance (Huber et al., 2021), financial development (Pascali, 2016), and scientific productivity (Waldinger, 2012, 2016; Akbulut-Yuksel & Yuksel, 2015). We depart from this literature as we are not concerned with isolating the effects of expulsions per se. Despite the possible negative effect of the expulsion of Armenians and Greeks on productivity, we argue that their centuries-long presence and co-existence with Muslim groups have positively transformed the development potential in these regions.

Within the context of the long-term legacy of inter-religious co-existence, our work is related to Grosfeld et al. (2013), who show that current non-Jewish residents of the Pale of Settlement exhibit higher anti-market attitudes and within-group trust, and lower entrepreneurship. They argue that the negative legacy of the *forced* co-existence of Jews and Christians was partly a byproduct of the anti-Jewish culture. In contrast, we find a positive legacy of *unforced* co-existence of Greeks and Armenians with their Muslim neighbors. The difference might be attributed to the involuntary nature of co-habitation in the Pale of Settlement, greater social and occupational segregation between Jews and Christians, and, possibly, stronger ethnic animosity towards Jews. After all, there is evidence that Jewish presence in pre-industrial Europe facilitated urban development where peaceful co-existence was achieved (Johnson and Koyama, 2017), religious tolerance was a catalyst for innovation during the second industrial revolution in Prussia (Cinnirella & Streb, 2017), and complementarities between diverse ethno-religious groups can foster innovation and economic activity (Ashraf & Galor, 2013; Hornung, 2019).

[5] However, we cannot test the validity of this mechanism due to the lack of historical data on inequality at the local level before and after the expulsions.

Second, we argue that the positive net legacy effect persisted largely due to the pre-departure influence of Armenian and Greek communities on human capital accumulation among Muslims. This connects our paper to the literature on the importance of human capital spillovers for development (Waldinger, 2010, 2012), and, in particular, the socio-economic influence of high-skilled ethno-religious groups (Becker & Woessmann, 2009; Hornung, 2014; Moser et al., 2014; Johnson & Koyama, 2017; Natkhov and Vasilenok, 2021). Our paper differs from this literature in its focus on whether the legacy effects persist in the absence of minority human capital, rather than capturing a combination of accumulated historical effects and the contemporaneous influence of human capital embodied in these groups.

Third, we add to the literature on the importance of human capital by studying the legacy of two communities that have received little attention –Greeks and Armenians of the Ottoman Empire. As an exception, Sakalli (2019) shows that the gains in educational attainment after the secularization of the Turkish education system in the early 1920s have been smaller in Turkish provinces with higher religiosity (proxied by Armenian population share). Both papers use Armenian share as an explanatory variable but for different purposes. We study the long-term legacy of minorities on development, while Sakalli (2019) focuses on the differential effect of an educational reform in areas with higher historical Armenian presence. Also, Grosjean (2011) shows that locations in South Eastern Europe with greater non-Muslim presence have relatively higher bank penetration today.

Our paper also relates to the work on historical path dependence. Most studies in this literature evaluate whether historical accidents and temporary shocks to population size, human capital and other productive assets can permanently change economic geography (O'Rourke, 1994; Davis & Weinstein, 2002; Nunn, 2008; Miguel & Roland, 2011; Bleakley & Lin, 2012; Jedwab et al., 2019). Our results suggest path-dependence in development driven by the legacy of highly skilled minority groups even though their economic ascent was interrupted by mass expulsions.

Lastly, we contribute to our understanding of the regional disparities in Turkish economic development (Altuğ et al., 2008; Pamuk, 1987; Toprak, 2012). For example, Asik et al. (2020) document the West-East divide in Turkey and the inverse-U shaped pattern in regional economic inequality since 1880. We show that the legacy of Armenian and Greek populations is not only an important contributor to the evolution of inter-regional disparities but it also explains variations at a more local level.

2 Historical background

2.1 Armenians and Greeks in Anatolia prior to the Ottoman rule

Majority of Ottoman Armenians lived for centuries in their historic homeland in eastern Turkey (western Armenian Plateau). Armenians dominated the region as early as the 1st millenium, from the first unified Armenian state of the Kingdom of Urartu (860BC-590BC) to the Armenian Kingdom of Cilicia (1080–1375). Following the adoption of Christianity as an official religion by the Kingdom of Armenia in 301, first religious schools were established. Throughout history, Armenian society ascribed an important role to education.[6] By the 10th century, most Armenian cities and many rural centers had elementary schools. As early as the 9th century, Armenians established institutions of higher education

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

(*Vardapetarans*). From 13th century on, some *Vardapetarans* transformed into universities and contributed to the growth of science and culture in Armenia (Khachikyan, 2010).

Greeks also inhabited Asia Minor for centuries before Turkish arrival. First Greek city-states were established in the 13th century BC (Burckhardt, 1998). Greeks settled predominantly in western and central Anatolia.[7] Byzantine Empire was the primary home to Greeks and Christianity became the state religion in the 4th century. Byzantine society was highly literate,[8] and literacy rates among Byzantine Greeks were higher than in the West with widespread access to elementary education and book ownership (Browning, 1989).

In the 11th century, Turkic tribes began to penetrate Asia Minor. Following Seljuk Turks' victory against the Byzantine army in 1071, numerous *Turkmen beys* (tribe leaders) started carving their own principalities out of formerly Byzantine Anatolia. Following the disintegration of Seljuk Sultanate of Rum, the Ottoman Beylik, a Turkish principality in northwestern Anatolia, conquered the remaining Byzantine territories in Anatolia. Islam's dominance in Anatolia was sealed by the Ottoman conquest of Constantinople in 1453.

2.2 Armenians and Greeks under the Ottoman rule

From its foundation in 1299 until its dissolution in 1922, the Ottoman Empire 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 Empire was Islam, it was tolerant towards other religions. Forced conversion to Islam was against the Sharia law and Islamization was never an official Ottoman policy (Deringil, 2000). Non-Muslims were free in their choice of residence and profession. 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. *Millet* system played a key role for the stability of the Ottoman order by governing the internal affairs of a multi-ethno-religious imperial setting. Under this system, non-Muslims enjoyed a degree of autonomy in their internal affairs pertaining to religious and cultural practices, education, fiscal matters, and civil law. In particular, each ethno-religious 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. 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.[9]

2.3 Armenians and Greeks in the economic sphere

The main premise of our paper is that Greeks and Armenians made significant contributions to local economies in Anatolia which in turn laid the ground for subsequent economic

[7] See Figure B.1 for maps of the historical homelands of Armenians and Greeks.

[8] 13th century Byzantine society had "a completely literate church, an almost completely literate aristocracy, some literate horsemen, and rare literate peasants" Oikonomidês and Langdon (1993).

[9] 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.

development in the post-expulsion period. Historical evidence supports the crucial economic role minorities played in the economic life of the Empire. In 1894/1895, 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* (Karpat, 1985). In high minority provinces, average population density was almost twice as high in 1893 as in the rest of the provinces (Figure B.2).[10] Importantly, this gap grew even larger by 1906, as high minority provinces experienced faster growth on average than low minority ones. Armenians and Greeks of the Ottoman Empire were ahead of the Muslim communities in their economic modernization. They were relatively more urbanized than Muslims and possessed superior agricultural knowhow (İnalcık & Quataert, 1994; Kieser, 2001). Gaps in educational attainment were also visible (Kuran, 2012). Across Ottoman provinces in 1894/95, the average proportion of primary school students within Greeks and Armenians combined was about 1.6 times as high as that of the Muslim community (Figure B.4).

By the 19th century, minorities had a disproportionate control over higher value-added sectors in trade, commerce, agriculture, and manufacturing, and owned greater wealth relative to Muslims (Kuran, 2004; Der Matossian, 2007; Kévorkian, 2011). For example, in the Black Sea region, Armenian and Greek merchants brokered trade between the West and locals. By the end of the 19th century, in the province of Trabzon, out of 33 exporters, 29 were Greek or Armenian while they made up only 40 percent of the population (Kuran, 2004). Along the Aegean, Greeks dominated commerce with 40–60% of the merchants, while their population share was 20–38% (Kuran, 2004). Similarly, in Istanbul, a predominantly Turkish city, Turks made up just 4% of export-import merchants by 1914.[11]

Individual-level data from the Ottoman Population Registers of the 1840s provide detailed information on the pre-expulsion occupational specialization along ethnoreligious lines. We have access to the whole universe of male households for three Anatolian cities: Ankara, Bursa and Manisa.[12] The resulting sample contains about 14,300 individuals of which 16 percent were Greeks and 22 percent were Armenians. Tables 1 and B.1 tabulate occupation groups and sub-groups, respectively, in which Armenians and Greeks

[10] Ottoman economy was still largely Malthusian at the time, and hence, the difference in income per capita understates the actual productivity gap, while population density is a more relevant proxy for productivity.

[11] Official statistics also confirm these numbers. According to the Ottoman yearbook of 1912, Muslims of the empire, 81% of the total population, had no role in trade with Europe with only a limited role in local trade as 15% of local traders (Sonyel, 1993).

[12] This data have been collected and digitized as a part of the UrbanOccupationsOETR (Industrialisation and Urban Growth from the mid-nineteenth century Ottoman Empire to Contemporary Turkey in a Comparative Perspective, 1850–2000) project funded by the European Research Council, Grant Agreement ID 679097. We are grateful to the principal investigator of this project Dr. M. Erdem Kabadayı for sharing the data. This dataset has been constructed by the manual reading and entry of around 19,000 individuals in 11 population registers from the Presidency of the Republic of Turkey, Directorate of State Archives (NFS.d.1396, 1398, 1742, 1754, 1755, 7140, 2865, 2866, 2867, 2868; ML.CRD.417). Data cover the entire universe of male household members in these cities and record, among other demographic and personal information, occupational titles and status in occupation each male household member holds (if any) along with ethnoreligious affiliation. We pool all individuals registered with an occupation and whose occupation could be matched to the PST classification. The original occupational titles used in the Ottoman population registers were standardized by the UrbanOccupationsOETR project using the PST and PSTI occupational coding schemes developed by the Cambridge Group for the History of Population and Social Structure (https://www.campop.geog.cam.ac.uk/research/occupations/datasets/coding), which has been a partner of UrbanOccupationsOETR. Table B.2 presents the overall occupational composition of the workforce.

were over-represented vis-a-vis their overall shares in the workforce.[13] Figures indicate that Armenians were over-represented as sellers, dealers of textile, medical professionals, in building and construction, and in manufacturing (such as instrument making, clothing, metal working, machines and tools, and precious metals). Despite their lower share in the overall workforce vis-a-vis Muslims, their numbers in all these occupational groups exceed that of Muslims. Greeks were over-represented in manufacturing (such as brick and tile production, precious metals, earthenware, metal working, food industries), building and construction, agriculture, as dealers, medical professionals, and sellers of food. Also, despite their lower share in the overall workforce than Muslims, they came to dominate Muslims in these sectors. Muslims, on the other hand, were most over-represented in forestry, transport and communications, local and national government service, armed forces, and agriculture. In short, most of the occupation groups Armenians and Greeks dominated can be considered as high-skilled or capital intensive occupations by the standards of the Ottoman economy in the 19th century.[14]

2.4 Expulsions and the process of ethno-religious homogenization

The Treaty of Berlin (1878) between the Ottoman Empire and the Western powers brought the Armenian Question onto the international stage. Meanwhile, concerns about the fate of the empire and 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. Dominant view within CUP prioritized Turkish ethnicity and the creation of a homeland with a Muslim majority (Zürcher, 2003). In 1915, CUP embarked on a wholesale anti-Armenian extermination policy and issued the "Temporary Law of Deportation" (*Tehcir Law*). Consequently, by the end of the WWI, more than one million Armenians of Turkey (with the exception of Istanbul) were removed from their homes through massacres and death marches (Kévorkian, 2011; Akçam, 2012; Dündar, 2008). From the eastern end of the Empire to the west, Armenian communities entirely disappeared due to either expulsions or the subsequent outmigrations of the remaining few.

The first wave of involuntary mass emigration of Greeks took place towards the end of the Turkish War of Independence in 1922 (Zürcher, 2003). Remaining Greek communities of the Empire were expelled en masse in 1923, as a result of the Convention Concerning the Exchange of Greek and Turkish Populations agreed by the Greek and Turkish governments at the Lausanne Conference. The convention stipulated an exchange of the Muslim populations in Greece for the Orthodox Greek populations in Turkey (with the exception of Istanbul). The exodus involved around 1.3 million Orthodox Greeks. In a matter of few years, the population exchange program achieved its goal of religious homogenization

[13] Degree of over-representation is the difference between groups' shares in the occupation and their share in the overall workforce. The table also reports those occupations where Armenians and Greeks constitute a larger fraction than Muslims and whether they dominate the occupation group, i.e. have the highest share.

[14] For example, the construction sector which was more intensive in craft and skills than it is today is a good example. It required knowledge about construction materials, measurement, drawing and building techniques as well as planning and organizational skills. Among the manufacturing sectors, instrument making, machine and tools making, textile and clothing are relatively more advanced in terms of human capital requirements. People working in the medical profession were without a doubt at the top of the education distribution. Being a dealer or seller required basic skills in arithmetic as well as trading skills, and, perhaps more importantly, it required more initial capital investment than many other occupations.

Table 1 Occupational groups in which minorities were over-represented according to Ottoman Population Registers of the 1840s

Panel A: Armenian over-representation	Degree of over- or under-representation of the group				Armenian rep.>	Armenians
	Armenian	Greek	Jewish	Muslim	Muslim rep.	dominant
Level of aggregation						
Occupation group						
Dealers	23.1%	−0.6%	0.1%	−22.5%	Yes	Yes
Construction	12.4%	28.5%	−2.3%	−38.5%	Yes	No
Manufacturing	4.2%	0.8%	−0.6%	−4.5%	Yes	No
Panel B: Greek over-representation	**Degree of over- or under-representation of the group**				**Greek rep. >**	**Greeks**
	Greek	Armenian	Jewish	Muslim	Muslim rep.	dominant
Level of aggregation						
Occupation group						
Construction	28.5%	12.4%	−2.3%	−38.5%	Yes	Yes
Agriculture	9.1%	−10.8%	−3.1%	4.9%	Yes	No
Fishing	5.1%	−1.1%	21.1%	−25.1%	Yes	No
Manufacturing	0.8%	4.2%	−0.6%	−4.5%	Yes	No

The sample includes the entire universe of male household members in the cities of Ankara, Bursa and Manisa in Turkey who declared an occupation. The listed occupation categories are standardized by the UrbanOccupationsOETR project using the PST and PSTI occupational coding schemes developed by the Cambridge Group for the History of Population and Social Structure (https://www.campop.geog.cam.ac.uk/research/occupations/datasets/coding)

rendering the Greek community of Turkey irrelevant in their original locations (Friedman, 2006).

While Armenian and Greek shares in the total population were, respectively, about 8% and 10% in 1893, more than 99% of Turkey registered Muslim by 1927 (excluding Istanbul).

3 Data

In this section, we briefly describe the main variables of interest and outcomes used in the baseline analyses at district and village/neighborhood levels. We provide a more detailed data description in Section A of the Online Data Appendix.

3.1 Historical Armenian and Greek populations at the district level

For historical distribution of Armenian and Greek minorities across Anatolia, we use the population figures in the Ottoman General Census of 1881/82-1893 (1893 Census

henceforth) that is reported in (Karpat, 1985).[15] This is the first comprehensive Ottoman Census where both males and females were counted. We use the 1893 Census instead of the Population Statistics of the Ottoman State in 1914 for one important reason. In the mid-1890s, large scale massacres were carried out against Armenians in eastern provinces, followed by the Adana massacre of 1909 (Adalian, 2010). The number of civilian casualties between 1894 and 1914 are estimated to be 200,000 to 300,000 (Akçam, 2006). Therefore, 1914 population figures are less suitable for an analysis of the long-term legacy of Armenian communities in Anatolia.

Unlike the Muslim groups that are lumped into one category, the 1893 Census classifies non-Muslim populations into various groups by nationality, ethnicity or religion, including Greeks and Armenians. 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). However, since we study modern outcomes, the unit of observation is a modern Turkish district (*ilçe*). Therefore, we assign each modern Turkish district to an Ottoman district using the detailed mapping between Ottoman location names and contemporary locations available in Sezen (2006). We exclude from our sample those Ottoman regions that are outside the contemporary boundaries of Turkey since our focus is on modern Turkish development.[16] Figure A.2 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 western coastal regions, Thrace in northwest Turkey, and eastern Black Sea coast.

3.2 District level outcomes

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 Turkey, long after the short- and medium-run effects of the radical demographic shifts and adjustments of the early 20th century have subsided. We exclude Istanbul from the sample as it is by far the most populous and developed province in Turkey.[17] The subnational nature of our empirical study requires detailed spatial data on economic development. Existing measures of regional income for Turkey are only available at the province level. In contrast, by 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.[18] Averaging across pixels that fall within district boundaries, we construct a measure of average

[15] Karpat (1985) deems the official Ottoman Census records as the most reliable and accurate source of information on the Ottoman population, as they were designed to meet administrative and military needs.

[16] In some Ottoman regions, the census was incomplete due to the difficulty of counting nomadic tribes. Therefore, in our main analysis we leave out those districts, but demonstrate in the Online Appendix that the results are robust to including them using rough estimates of uncounted people. In addition, areas under Russian occupation at the time of the census are not available.

[17] Our results are robust to including Istanbul in the sample.

[18] Night light data are from the Defense Meteorological Satellite Program's Operational Linescan System reporting images of the earth at night, overlaying all images captured during a calendar year.

light density in 2000 at the district level.[19] Figure A.1 depicts the cross-district distribution of average luminosity together with Armenian and Greek shares.

3.3 District level controls

To account for potential geographic and climatic factors that might have influenced the location of early Armenian and Greek settlements, our baseline controls include latitude, longitude, adjacency to sea, lakes and major rivers, mean and standard deviation of elevation, average annual temperature and precipitation, and agricultural suitability. Table B.3 in the Online Appendix shows the summary statistics for all the variables we use in our district-level analysis, including several robustness controls.

3.4 Village/neighborhood level data

The unit of observation is a contemporary locality, which is either a village or a neighborhood depending on the official rural/urban status of that locality. We proxy the long-run presence of minorities at the village/neighborhood level using the number of public buildings (schools, churches, monasteries, chapels, cemeteries and hospitals) within a given radius of each locality that used to belong to Armenian and Greek communities. These data come from the Cultural Heritage Map of Turkey.[20] We use night light density within a given radius around each locality as our outcome measure. We also account for a set of geographic characteristics as well as historical and contemporary correlates of development. Geographic characteristics 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). Finally, as a historical proxy for densely populated locations with significant Muslim presence, we use newly geo-coded data on the locations of historical mosques and Islamic school buildings (*madrasas*) that were built before the foundation of the Turkish Republic.[21]

[19] Luminosity has been used as a proxy of economic development (Henderson et al., 2012; Michalopoulos & Papaioannou, 2013). As an internal assessment, Figure B.6 shows a strong positive correlation at the province level between income and luminosity in 2000, offering direct evidence that luminosity is a good proxy for local economic activity in the Turkish context.

[20] The map was produced as part of the Cultural Heritage Inventory Project sponsored by the Hrant Dink Foundation. It is based on historical information gathered from primary and secondary sources as well as archives. See https://turkiyekulturvarliklari.hrantdink.org/.

[21] We digitized these data from the Turkish Culture Portal, maintained by the Ministry of Culture of the Turkish Republic (https://www.kulturportali.gov.tr).

4 Results

4.1 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 led to an almost complete removal of Armenian and Greek communities out of their homelands in Turkey with the exception of Istanbul. We can thereby rule out contemporaneous influence of these groups on development and employ pre-expulsion population shares of Armenians and Greeks as proxies for historical exposure of each district to minority presence. Our baseline specification is

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

where y_i is an outcome of interest (e.g. luminosity 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_i to which district i was assigned. In our preferred specification, 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. We control for population density in 1927 –the first census after the expulsions– as the best available proxy for historical local development in the aftermath of the expulsions. This way the coefficients on minority shares reflect the relative economic performance throughout the post-expulsion period of those locations with higher historical exposure to Greek and Armenian presence.[22] $\mathbf{X}_i$ denotes the set of exogenous geographic and climatic factors that might have influenced locations of early Armenian and Greek settlements. R_i denotes modern region/sub-region/province fixed effects. Standard errors are clustered at the modern province level. The identifying assumption for the baseline OLS estimation is that, conditional on historical population density, region specific fixed effects, and geographic factors that might have driven minority settlement patterns, the remaining unexplained drivers of contemporary economic activity should not be correlated with historical minority shares.

4.1.1 Minorities, population density and urbanization

As a first measure of development, we examine the evolution of population density in the aftermath of the expulsions across districts with differential minority exposure.[23] We start out with the short-term impact of expulsions on regional population density in 1927. Figure 1 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 (see also Panel A of Table B.5). Among areas with

[22] We have chosen the *first* census year after the expulsions to capture the entire *legacy effect* of past minority presence on economic performance while removing any contemporaneous influence of minority human capital when Greeks and Armenians were still living in these regions. If we alternatively control for a rough proxy of population density in 1893 or population density in 1935 instead of 1927 as a benchmark, our main findings are unaltered (see Section C.6 and Tables C.10 and C.11 in the Online Appendix for details).

[23] Earlier research has also employed population density as a proxy for development and productivity (Ashraf & Galor, 2011; Galor, 2011; Galor & Weil, 2000).

similar levels of population density before Armenian and Greek expulsions, those with higher shares of minorities were significantly less populated five to ten years after the expulsions and mass killings.

In the longer-run, however, the recovery process eliminates the post-expulsion gap between low- and high-minority areas and it eventually leads to the (re)emergence of significant differences in population density in favor of the latter. For instance, comparing the population dynamics of previously high- and low-minority districts, Figure 2 shows that high-minority areas grew faster on average than low-minority ones, leading to an eventual divergence.[24] More systematically, Figure 3 shows that districts with greater concentration of historical minorities are indeed more densely populated in 2000.[25] Thus, Figures 1, 2, and 3 together support the view that, despite enduring negative shocks to population, over the longer term, regions with greater former minority presence overtook their ethno-religiously more homogeneous counterparts. A move from-10th-to-90th percentile of minority shares increases population density in 2000 by 23 and 21 percent, for Armenians and Greeks respectively (see Panel B of Table B.5).

As a second measure of development, we assess the long-run legacy of minorities on urbanization rates in 2000. Urbanization captures better the degree of economic modernization than population density and it highly correlates with income per capita.[26] Figure 4 shows that districts with greater historical exposure to minority presence are significantly more urbanized in 2000 even after controlling for the baseline geographic characteristics and subregion fixed effect (Table B.6). A move from the 10th to the 90th percentile of the Armenian share distribution is associated with a 9.2 percentage point increase in urbanization rate in 2000, whereas the same effect is 5 percentage points for Greek population shares.

4.1.2 Historical minority presence and nighttime lights

Our main measure of 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 relationship between historical minority presence and luminosity, once potentially confounding factors are accounted for. The evidence in Table 2 corroborates our conjecture. Both Armenian and Greek shares are highly significant and positive predictors of modern economic development in 2000, conditional on past population density, and geographic and regional factors (see our baseline specification in column 7).[27] Raising Armenian share from the 10th to the 90th percentile is associated with a 24.8 percent increase in average luminosity, while the same effect is 32 percent for Greek share (column 7).[28] It is worth noticing that the estimates are sensitive to the omission

[24] While this figure compares aggregate trends, Figure B.5 shows the divergence between these two groups conditional on year and district fixed effects.

[25] This finding is not sensitive to region (7), subregion (21) or province (81) fixed effects. The results are also robust to including regions where the Ottoman census of 1881-1893 was incomplete (Table B.7).

[26] 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 periods.

[27] Partial correlation plots in Figure B.7 suggest that the results are not driven by influential outliers.

[28] We also carried out an R^2 decomposition exercise to assess the importance of minority legacy relative to other channels for explaining subnational comparative development (e.g. see Ashraf et al. (2021)). In the baseline regression of luminosity in column 7 of Table 2, the relative contribution of the minority legacy to the overall R^2 is 9.11%, whereas historical population density as a proxy for historical development contributes 29.08% and all of the 10 geographical controls add 43.5%. Therefore, the relative importance of

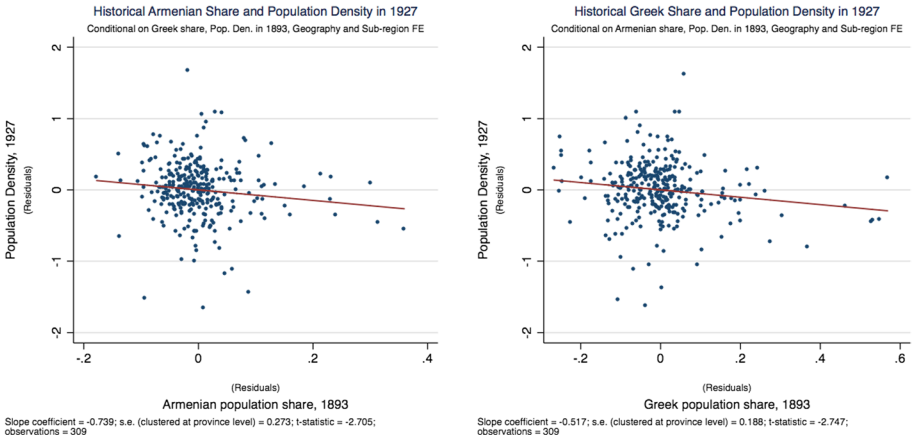


Fig. 1 The short-term impact of expulsions on population density

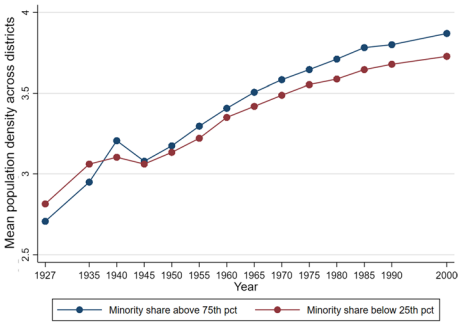


Fig. 2 Post-expulsion Population Trends, 1927-2000. *Notes*: This figure plots for each census year the averages of the natural logarithm of population density for two groups of modern Turkish districts: Those where the sum of historical population shares of Armenians and Greeks (i.e. minority share) measured in 1893 is above the 75th percentile of the corresponding cross-district distribution, and those where it is below the 25th percentile

of regional and geographic characteristics, reflecting a downward bias due to negative selection of Armenians and an upward bias due to positive selection of Greeks. This is not surprising when we consider the historical homelands of Armenians and Greeks and the influence of the west-east gradient that historically characterized development potential in Anatolia.[29] 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

Footnote 28 (continued)
the minority legacy is rather substantial as it corresponds to 31% and 21% of the contributions of historical population density and all the geographic controls, respectively.

[29] Figures A.1 and B.3 hint at negative selection for Armenians and positive selection for Greeks.

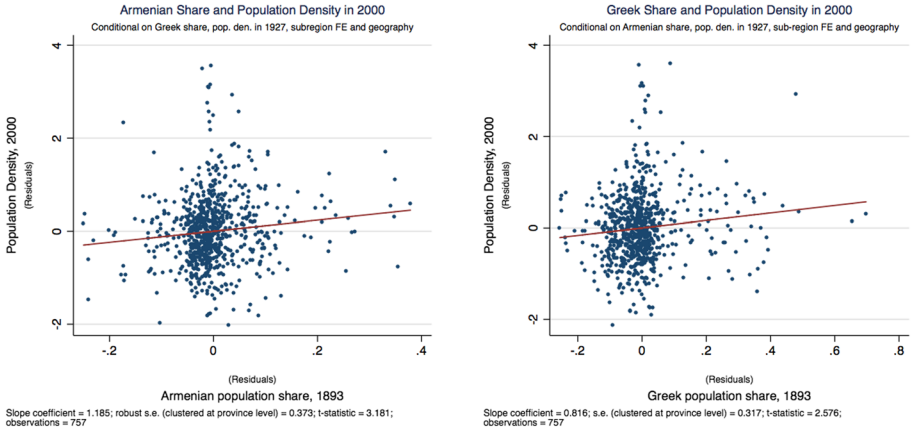


Fig. 3 The long-run legacy of minority presence on population density

of the influence of Armenian presence on development, an issue we further investigate in Sect. 4.5.[30]

Back of the envelope calculations suggest that these magnitudes are economically meaningful.[31] A modern province with a 20 percent (90th percentile) historical Armenian share has 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. Instead, a modern province with a 26 percent (90th percentile) historical Greek share has 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.

4.1.3 Addressing threats to identification

While Section C in the Online Robustness Appendix provides a detailed discussion of the threats to identification, sources of bias, and how we carry out our robustness analyses, we give a brief outline here. Despite taking into account a wide range of geo-climatic factors and subregion/province fixed effects, we cannot rule out potential selection of minorities based on local drivers of development (Section C.1). Our first strategy is to account for a rich set of correlates of historical and contemporary development that may confound minority share coefficients (Section C.2). We show that our results are robust to taking into account access to railroads and ports, exposure to war, historical settlement of migrants,

[30] We additionally ran quantile regressions to see where the effect is stronger. Figure B.8 plots the coefficients on Armenian and Greek shares at different quantiles of luminosity. For both Armenian and Greek effects, quantile regression coefficients at different quantiles lie mostly within the OLS confidence intervals (although there is an increasing pattern at higher quantiles). Especially for the Greek effect, quantile regression coefficients overlap with the OLS confidence interval to a great extent. Perhaps, for the Armenian effect, one could make a case for a somewhat stronger effect at the very high quantiles.

[31] Based on the unconditional relationship between gross regional product per capita and average luminosity across Turkish provinces (Figure B.6).

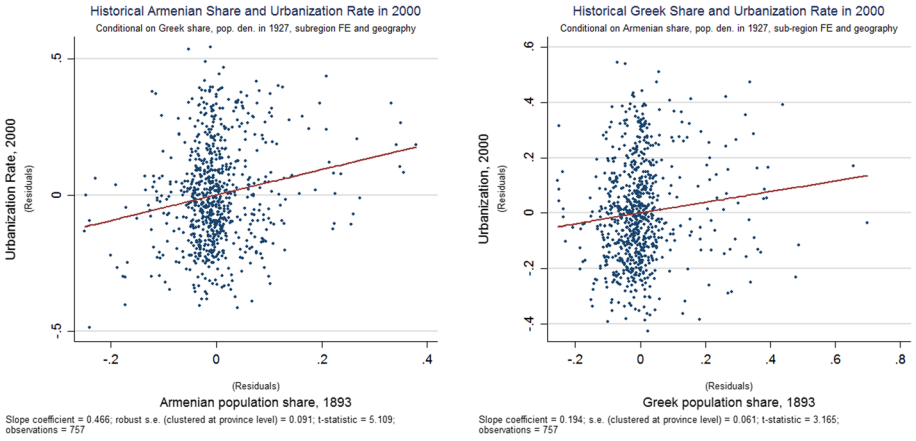


Fig. 4 The long-run legacy of minority presence on urbanization rates

historical Kurdish presence, historical regional centers, distances to Istanbul and nearest national borders, and distance to old trade routes (Table C.1).

One important concern is that development potential might have driven early settlement patterns. To address this, we account for three deep-rooted factors that have certainly shaped pre-historic human settlement patterns in Anatolia over the course of history. These are Neolithic settlements based on archaeological data (as a proxy for prehistoric conditions that were favorable to agriculture and amenable to permanent settlement), ancient Greek sites dating to the Classical (480–323 BC) and the Hellenistic (323–146 BC) periods, and proximity to Tushpa (Van) as the capital of the ancient Urartu (Van) Kingdom (860-590 BC) (first unified Armenian State). Our results are remarkably robust to taking into account early selection and settlement patterns (Section C.3 and Table C.3).

We also assess the extent of omitted variable bias using two related methods (Altonji et al., 2005; Oster, 2019). Altonji et al. (2005) ratios are reasonably large (4.3 for Armenians and 3.05 for Greeks), while (Oster, 2019) tests for coefficient stability show that selection on unobservables is unlikely to explain away our results (Section C.4 and Table C.4).

Importantly, we carefully carry out covariate and propensity score matching analyses to have better counter-factual control districts for the treated ones, mitigating endogeneity concerns. Matching allows us to more flexibly account for observable characteristics and it improves identification by focusing on a smaller sample of common support where treated and untreated districts are more comparable. Our baseline findings are confirmed in the matching exercises (Section C.5 and Tables C.5, C.6, C.7, C.8, and C.9).

To address concerns about spatial correlation, we perform multiple exercises, largely following (Kelly, 2019). The conclusion is that our results are not simply driven by spatial correlation. Section C.7 provides a detailed discussion (see Figure C.1 and Table C.12).

To sum up, our baseline conclusions from the district-level analysis qualitatively survive a rich battery of robustness exercises, and selection on omitted factors must be fairly strong to explain away these results. Therefore, taken together, the evidence we provide makes a strong case for a causal positive legacy of Greeks and Armenians on current regional development. In the next section, we analyze the link between minority presence and development at a much finer geographic scale, allowing us to account for district-level fixed effects and thus to further mitigate concerns about selection on unobservables.

Table 2 Historical Minority Shares and Average Luminosity in 2000

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) OLS	(8) OLS
	Dependent variable: Log Average Luminosity in 2000							
Armenian population share, 1881-1893	−0.539		−0.145	0.661	1.149**	1.191***	1.250***	1.242***
	(0.685)		(0.639)	(0.441)	(0.463)	(0.349)	(0.372)	(0.362)
Greek population share, 1881-1893		2.385***	2.371***	1.472***	1.354***	1.370***	1.241***	0.694***
		(0.446)	(0.444)	(0.317)	(0.282)	(0.298)	(0.296)	(0.218)
Log(Population density, 1927)						0.706***	0.678***	0.683***
						(0.078)	(0.084)	(0.085)
Geographical controls				×	×	×	×	×
Modern sub-region dummies					×		×	
Modern province dummies								×
Observations	757	757	757	757	757	757	757	757
Adjusted R^2	0.002	0.099	0.098	0.345	0.411	0.476	0.513	0.596
Effect of 10th–90th %ile move in Armenian share	−10.722		−2.876	13.161	22.871**	23.696***	24.874***	24.710***
	(13.622)		(12.717)	(8.769)	(9.217)	(6.952)	(7.412)	(7.195)
Effect of 10th–90th %ile move in Greek share		61.474***	61.106***	37.940***	34.904***	35.307***	31.995***	17.884***
		(11.484)	(11.448)	(8.166)	(7.277)	(7.683)	(7.622)	(5.621)

This table presents results from the regressions of Log Average Luminosity in 2000 on historical minority shares controlling for past population density, geographic characteristics, subregion or province fixed effects. Geographical controls are longitude, latitude, mean and standard deviation of elevation, lake, sea and major river presence, average temperature and precipitation, and suitability to cultivation. 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 parentheses. *** denotes statistical significance at the 1 percent level, ** 5 percent level, and * 10 percent level

4.2 Village/neighborhood level evidence

In this section, we employ villages and neighborhoods (localities) as the unit of analysis –instead of districts. In particular, we exploit *within-district* variations in the *proximity to minority community buildings* across localities, instead of within-subregion variations in minority population shares across districts. In doing so, we are motivated by two related goals. First, we evaluate the legacy of historical minority settlement patterns on the spatial organization of current economic activity at a highly localized level. Second, the fine geographical scale of the data allows us to account for district-level fixed effects.[32] Unobservables that could shape both the historical distribution of economic activity and ethnoreligious demography within a subregion or province become less relevant when we focus on variations across localities within a district. The units we compare are not only geographically and culturally similar, 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.

We employ the geo-coded locations of community buildings as a proxy for minority presence at the very local level. This is a natural choice since we do not have minority figures at the neighborhood/village level from historical censuses. Besides the locational detail it offers, building data have the advantage of capturing a larger fraction of minority settlements 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 vicinity of more than 49,000 localities, conditional on a large set of potential confounders. Our estimating equation is

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

where i is a locality (village or neighborhood). $(AvgLum5km)_i$ is the log of mean luminosity in year 2000 within 5km radius of i.[33] $(ArmBld5km)_i$ and $(GreBld5km)_i$ are binary variables indicating the presence of at least one historical Armenian and Greek community building within 5km of locality i, respectively.[34] We choose to employ binary indicators because the number of buildings has an extremely right-skewed distribution. By using a building dummy, we can also reduce measurement error and better isolate the contribution of mere minority presence from the additional influence of the level of historical prosperity of minority groups. $\mathbf{X}_i$ is a vector of geographic, historical and contemporary correlates of development. δ_i denotes district fixed effects. We cluster standard errors at the province level.

Table 3 summarizes our results. Columns 1–7 in Panel A use the entire sample, pooling together villages and neighborhoods in towns, while column 8 reports results for the sample of villages only. In a step-wise fashion, we introduce our variables of interest, geographical controls, province and district fixed effects, as well as historical (e.g. proximity to historical urban centers and old trade routes) and contemporary (e.g. distance to contemporary railroad network and biggest commercial/industrial centers) correlates of development. In the stringent specification of column 6 with all controls and district fixed effects

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

[33] 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.

[34] The map in Figure B.9 presents the distribution of historical minority buildings.

Table 3 Minority Legacy on Local Development – Village/Neighborhood Level Analysis

PANEL A								
Sample	All localities							Villages
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Dependent variable: Log Average Luminosity (in 2000) within 5km circle around village/neighborhood								
Armenian building within 5km	1.524***		0.804***	0.938***	0.778***	0.499***	0.485***	0.646***
	(0.149)		(0.087)	(0.082)	(0.078)	(0.068)	(0.068)	(0.073)
Greek building within 5km		2.039***	0.761***	0.584***	0.470***	0.225***	0.199**	0.459***
		(0.180)	(0.093)	(0.074)	(0.093)	(0.080)	(0.080)	(0.146)
Muslim religious or school building within 5km							0.258***	0.598***
							(0.096)	(0.125)
Type of locality (village/neighborhood)	×	×	×	×	×	×	×	
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	0.158	0.188	0.363	0.451	0.611	0.644	0.645	0.503
Effect for Armenian community buildings	362.091***		124.426***	156.637***	118.578***	65.184***	62.771***	92.289***
	(69.083)		(19.630)	(21.023)	(17.148)	(11.245)	(11.181)	(14.119)
Effect for Greek community buildings		673.820***	114.869***	79.876***	60.357***	25.422**	22.183**	58.455**
		(140.227)	(20.161)	(13.287)	(15.037)	(10.061)	(9.858)	(23.209)

Table 3 (continued)

PANEL B								
Sample	All localities				Villages			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Dependent variable: Log Average Luminosity (in 2000) within 5km circle around village/neighborhood								
Armenian building within 5km		0.442***		0.372***		0.571***		0.496***
		(0.063)		(0.053)		(0.064)		(0.170)
Greek building within 5km		0.177**	0.099			0.397***	0.324	
		(0.076)	(0.092)			(0.132)	(0.236)	
Armenian building between 5 to 7km	0.445***	0.407***			0.635***	0.548***		
	(0.052)	(0.046)			(0.069)	(0.060)		
Greek building between 5 to 7km	0.231***	0.214***			0.366***	0.331***		
	(0.063)	(0.058)			(0.096)	(0.083)		
Log Density of Armenian buildings within 5km			0.424***				0.523***	
			(0.070)				(0.105)	
Log Density of Greek buildings within 5km				0.105**				0.053
				(0.040)				(0.064)
Type of locality (village/neighborhood)	×	×	×	×				
Geographical controls	×	×	×	×	×	×	×	×
Near an Ottoman city	×	×	×	×	×	×	×	×
Distance to historical trade routes	×	×	×	×	×	×	×	×
Contemporary controls	×	×	×	×	×	×	×	×
Muslim building controls	×	×	×	×	×	×	×	×
Bucak/District FE	×	×	×	×	×	×	×	×
Observations	49321	49321	11000	8111	18288	18288	2762	1147

Table 3 (continued)

PANEL B								
Sample	All localities				Villages			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Adjusted R^2	0.645	0.650	0.799	0.834	0.500	0.511	0.569	0.636
Effect for Armenian community buildings	56.488***	50.529***			90.105***	74.126***		
	(8.254)	(6.908)			(13.292)	(10.515)		
Effect for Greek community buildings	26.082***	23.947***			44.365***	39.392***		
	(7.952)	(7.269)			(13.969)	(11.592)		

Dependent variable is log average luminosity (measured in year 2000) within 5km radius around the village/neighborhood centroid. In Panel B, specifications (3) and (7) are conditional on having at least one Armenian building in the locality, whereas specifications (4) and (8) are conditional on having at least one Greek building in the locality. All regressions include a location type indicator. 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 to 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. Marginal effects reported in the bottom two rows show how much (in percentage terms) higher average luminosity within 5km is expected to be if there is at least one minority building within 5km of the locality as opposed to none

–allowing us to compare very similar localities in close proximity– minority presence is a positive and significant predictor of local economic activity.

Column 7 introduces a dummy for the presence of historical mosques and Islamic schools (*madrasas*) within 5km. Once conditioned on proximity to Muslim community buildings, we identify the local minority influence from the variations across localities that were similarly attractive for Muslims due to the benefits from agglomeration, agricultural potential, or other unobservable locational fundamentals. Thus, if previous results were merely driven by overall agglomeration economies –i.e. proximity to developed environment of the past and not proximity to minority settlements per se– the coefficients for Armenian and Greek presence should greatly diminish in size and significance. Column 7 shows that even though Muslim building coefficients are positive –suggestive of potential agglomeration effects– Armenian and Greek coefficients hardly change. This reassures us that our minority estimates are not merely driven by agglomeration effects. According to this most preferred specification, a location within 5km of an Armenian community building is 62 percent more lit up than another comparable location in the same district, whereas the Greek effect is 22 percent.

One might be concerned that the results are driven by relatively more urbanized locations. In historically more urban centers, Muslim and non-Muslim buildings might have clustered together, and hence, neighborhoods near urban centers might reflect the confounding effect of urbanization. To address this, column 8 estimates our most stringent model on the sample of villages only. The resulting estimates are significantly more sizable.[35] Although minority presence is a strong predictor of both historical and contemporary urbanization –as established in our district-level analysis– these findings suggest that the strong minority legacy on local development is not merely an urban phenomenon. Minority villages are far from losing out to historically Muslim villages, and, today, the ones that were home to local Armenian and Greek communities are significantly more prosperous.

In columns 1 and 2 of Panel B of Table 3, we analyze whether minority presence outside the 5km radius circle predicts luminosity within that circle. This exercise addresses the concerns that, first, despite the locational fixed effects, minority buildings may still be picking up the influence of unobserved factors making that locality more attractive; and second, variation in luminosity is driven by the lights emanating from the very buildings we measure. Column 1 shows that minority buildings within 5 to 7km (the outer ring) still have a positive and significant effect on luminosity within 5km of a locality. A horse race between buildings within the 5km circle and the outer ring indicates that buildings in the outer ring remain significant and the magnitudes are comparable (column 2). These results suggest that proximity to minority settlements, i.e. spatial spillovers, plays a non-trivial role.

In columns 3 and 4, to isolate the role of minority settlements at the intensive margin, we explore how luminosity is related to the density of Armenian and Greek buildings in localities with at least one Armenian or Greek building within a 5km radius, respectively. This gets us closer to a backdoor-criterion identification, i.e. once we account for selection into locations, the intensity of treatment (density of minority buildings) is not confounded by omitted factors. Conditional on having an Armenian (Greek) building nearby, the greater is the Armenian (Greek) settlement density the higher is luminosity within 5km of a locality.[36]

[35] Results remain qualitatively similar when we exclude observations with potentially censored outcomes.

[36] All of the above exercises hold if we limit the sample to villages (columns 5–8, Panel B).

5 Potential channels for persistent minority legacy

This section discusses potential mechanisms for minorities' positive legacy in the post expulsion period. Section 5.1 shows that Muslims in high minority areas had greater human capital prior to and in the immediate aftermath of the expulsions as well as in modern-day Turkey. We offer supportive evidence that higher levels of human capital among Muslims in ex-minority areas (both in the past and today) are in part a consequence of the transfer of skills and knowledge that Armenians and Greeks increasingly possessed throughout the second half of the 19th century. We argue that inter-group human capital spillovers is the most likely mechanism. In Sect. 5.2 we examine the potential role of physical assets minorities left behind. Section 5.3 concludes with an evaluation of alternative mechanisms.

5.1 Direct effect of minorities on Muslim human capital

> *"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)

As evidenced in the historical background, minorities had a significant representation in high-skilled and educated segments of the Ottoman society. For example, in the poorer eastern provinces, human capital of the Armenian community and the know-how of their artisans stood out vis-a-vis Muslims (Kévorkian, 2011). While Greek and Armenian philanthropic and religious institutions were channeling community resources into education, majority of Muslims lacked adequate education and skills, deepening the discrepancies between non-Muslim and Muslim human capital.[37]

We argue, however, that proximity to Greek and Armenian communities conferred a counteracting positive influence on the human capital of Muslims. The mechanism we favor is the inter-group human capital spillovers via the diffusion of occupational knowledge and entrepreneurial skills. Economic interactions over this long period would result in intergroup transmission of skills and knowledge in agriculture, craftsmanship, trade and commerce. Muslims working with or competing against minorities in the domestic market had an advantage in adopting superior know-how, production techniques as well as commercial initiative, compared to Muslims without such exposure. Below, we provide supporting evidence for our most favored hypothesis in several steps.

5.1.1 There was reasonably large scope for inter-group economic interactions and human capital spillovers

Anecdotal evidence from the late Ottoman period suggests that different religious communities regularly interacted in the economic sphere.[38] For instance, in the province of

[37] Primary school enrollment rates in the late 19th century were higher among non-Muslims (Figure B.4).

[38] Local testimonies on social life in Palu suggest that Kurds, Armenians, and Turks regularly interacted in the town market, and Palu male Armenians mastered Turkish and Kurdish due to economic incentives Houshamadyan Project (2013).

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 even had joint enterprises on occasion (Kekeçoğlu, 2007).[39] Local histories of Ottoman towns with significant non-Muslim presence are full of more direct anecdotal evidence about transfer of economically relevant skills and knowhow from minorities to Muslims.[40]

Beyond anecdotal evidence, to buttress the idea that there was considerable scope for inter-religious economic interactions in Ottoman towns, we provide descriptive evidence from the Ottoman Population Registers of 1840s for three Anatolian cities (each covering the entire city population). Table 4 reports intra-occupational religious diversity for Ankara, Bursa and Manisa.[41] Panel A reports a weighted average of within-occupation religious diversity across all occupation groups represented in each city. To benchmark these statistics, we also provide information about the size of the labor force and the share of Muslims in the labor force. Panel B reports religious diversity indices separately for main occupation groups in which Armenians and/or Greeks were historically over-represented (as in Tables 1 and B.1).

There are two takeaways. First, there was considerable within-occupation diversity to allow for inter-religious interaction between people in similar occupations. In all three cities, there was on average more than 40% chance that two randomly selected individuals from the same occupation group will be a Muslim and a non-Muslim. Hence, descriptive evidence from micro data supports anecdotal accounts of inter-group interactions in the economic sphere. Moreover, intra-occupation religious diversity was quite similar across the three cities despite different city sizes (comparing Manisa and Ankara to Bursa). Second, in all three cities, manufacturing and sellers were among the most diverse occupation groups. These were also among the occupation groups Armenians and Greeks were over-represented.

5.1.2 Muslims in high minority areas had greater human capital than other Muslims already before the expulsions of minorities

If co-existence with minorities contributed to human capital accumulation among Muslims, then we should see differential Muslim education levels between high and low minority areas already before the expulsions. Consistently with this hypothesis, Figure 5 shows exactly that by providing descriptive evidence of greater average primary school enrollment rates among Muslims who lived in high minority areas than Muslims in low minority areas across Ottoman provinces in 1894/1895.[42] Importantly, Figure 6 provides more systematic evidence on the positive relationship between Muslim middle-school enrollment rate (students per Muslim population) in 1893 and Armenian and Greek population shares

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

[40] To give one example, in her historical study of the city of Antakya (*Antioch*), Eraslan (2009) writes that Muslims learned how to produce copperware and knives from Armenian masters. She also tells the story of the biggest Muslim sericulturist family in the region who learned silk manufacturing from Armenians of Haleppo and established their own business in the early 1900s.

[41] The measure of religious diversity allows for two groups (Muslims and non-Muslims) and is based on the fractionalization index. It captures the likelihood that one of the two randomly selected individuals from the same occupation group will be Muslim and the other one non-Muslim.

[42] Despite low number of observations, a simple partial regression plot in Figure B.10 supports this finding.

Table 4 Religious diversity within occupation groups in three Ottoman cities

Panel A: Average religious diversity within all occupation groups			
City name	Size of labor force	Average religiousdiversity (intra-occupation)	Share of Muslims in labor force
Ankara	3,823	0.45	0.49
Bursa	6,778	0.41	0.63
Manisa	3,886	0.43	0.61

Panel B: Religious diversity within occupation groups by city				
City	Ankara		Bursa	
rank	Occupation group	Religious diversity	Occupation group	Religious diversity
1	Manufacturing	0.49	Agriculture	0.48
2	Sellers	0.48	Manufacturing	0.48
3	Dealers	0.42	Sellers	0.46
4	Services and Professions	0.41	Dealers	0.40
5	Agriculture	0.28	Construction	0.38
6	Construction	0.25	Services and Professions	0.28
City	Manisa		Weighted average of 3 cities	
rank	Occupation group	Religious diversity	Occupation group	Religious diversity
1	Sellers	0.50	Manufacturing	0.49
2	Manufacturing	0.50	Sellers	0.48
3	Agriculture	0.48	Agriculture	0.45
4	Services and Professions	0.40	Dealers	0.40
5	Dealers	0.32	Services and Professions	0.34
6	Construction	0.24	Construction	0.32

The table reports religious diversity within occupation groups in three Ottoman cities based on the micro data from Ottoman population registers circa 1840s. The occupation groups are Manufacturing, Sellers, Dealers, Services and Professions, Transport and Communications, Agriculture, Construction, Fishing and Forestry. In Panel A, the average religious diversity is the weighted average (across all occupation groups) of the likelihoods that two randomly picked residents in each occupation group in the city will be of a different group (Muslim versus non-Muslim). The weights are the sizes of each occupation group relative to the total employment in the city. In Panel B, diversity is computed likewise but reported by city and for the six occupation groups in which Armenians and/or Greeks were historically over-represented. When computing the weighted average of 3 cities in Panel B the weights are equal to the city's share of the total labor force (across the three cities) employed in that occupation group

at the Ottoman district level. This relationship is robust to controlling for Ottoman province (*vilayet*) or county (*sancak*) fixed effects.[43]

[43] In unshown regressions, the relationship also holds at the intensive margin when excluding from the sample Ottoman districts with no middle-school or directly controlling for the number of schools in districts.

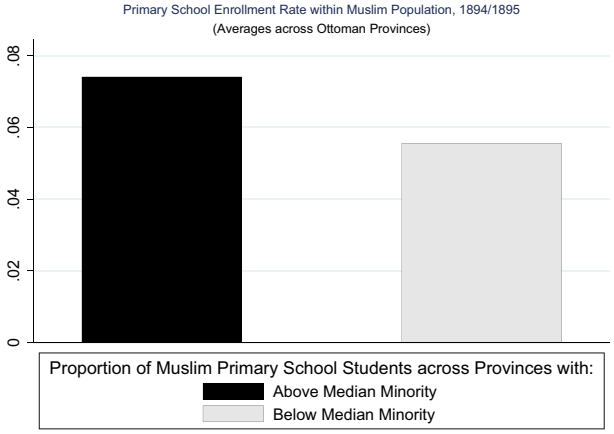
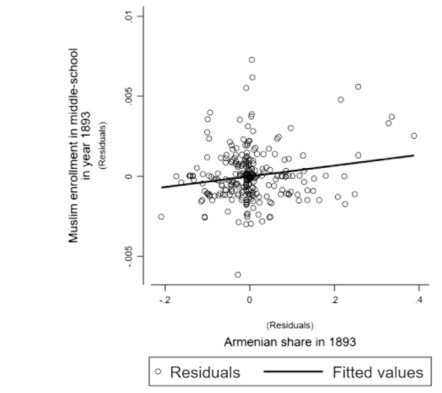
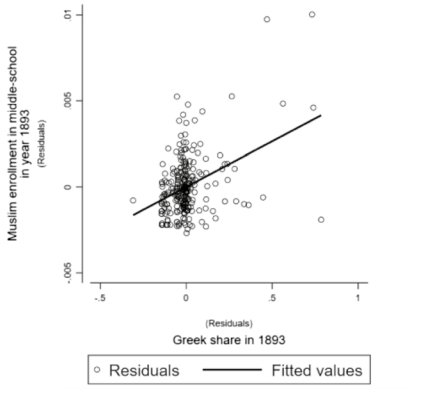


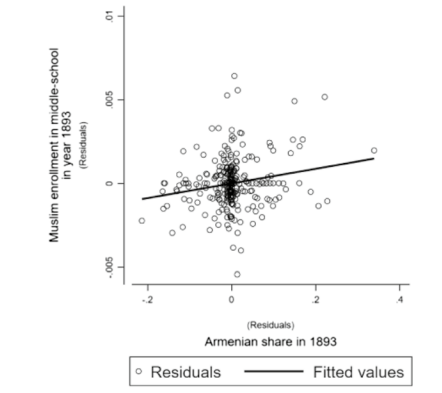
Fig. 5 Educational attainment among Muslims in High vs. Low Minority Provinces, 1894/1895



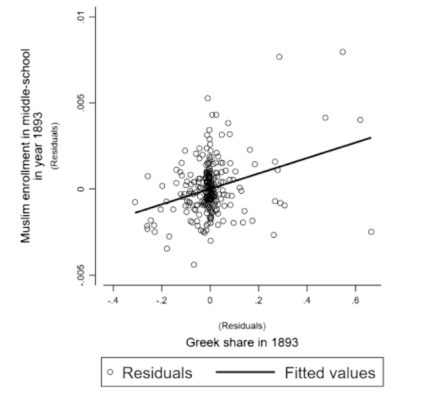
(a) Armenian presence with Ottoman Province FE



(b) Greek presence with Ottoman Province FE



(c) Armenian presence with Ottoman County FE



(d) Greek presence with Ottoman County FE

Fig. 6 Minority shares and Muslim Enrollment Rate in Middle-School in 1893

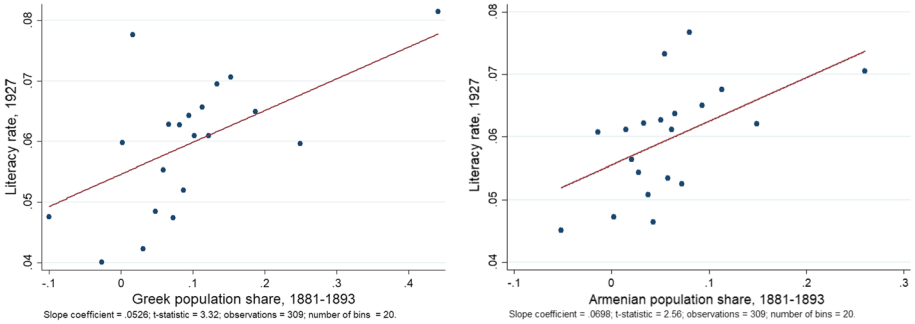


Fig. 7 Historical Minority Presence and Literacy in 1927 *Notes*: The figure presents binned scatter plots showing the relationship between the literacy rate in 1927 (in the aftermath of the expulsions) and the Greek and Armenian minority shares in 1893 (prior to expulsions) conditional on female/male ratio in 1927, share of population below 13 years of age, baseline geographic controls, subregion FEs and the population share of the other group in 1893. The plots are based on binned averages (for each of 20 bins) of the literacy rate and population share of the indicated minority group. Original unit of observation is a district in 1927, hence the smaller sample size than our contemporary district-level regressions

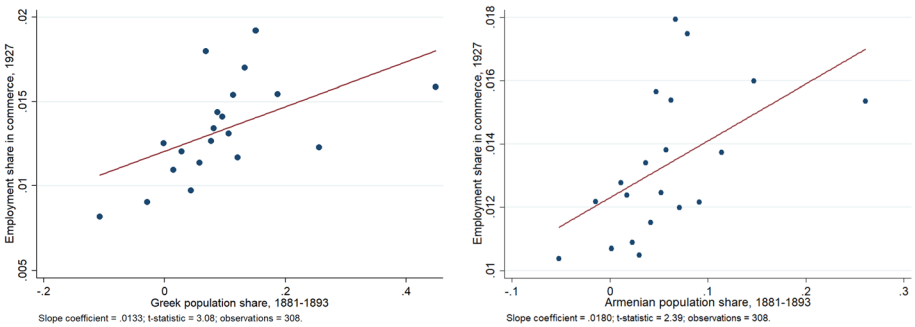


Fig. 8 Historical Minority Presence and Employment Share in Commerce in 1927. *Notes*: The figure presents binned scatter plots showing the relationship between the share of employment in commerce in 1927 (in the aftermath of the expulsions) and the Greek and Armenian minority shares in 1893 (prior to expulsions) conditional on baseline geographic controls, subregion FEs and the population share of the other group in 1893. The plots are based on binned averages (for each of 20 bins) of the employment share in commerce and population share of the indicated minority group. Original unit of observation is a district in 1927, hence the smaller sample size than our contemporary district-level regressions

5.1.3 Expulsions did not eliminate the human capital differences between high- and low-minority areas

Did differences in Muslim human capital survive the expulsions? To answer that, we use data on literacy rates from the first Turkish census after the expulsions in 1927. Close to 99 percent of Turkey's population registered Muslim by 1927 and a significant share of those must have coexisted with the minorities prior to expulsions. Thus, literacy rates in 1927 capture the human capital of remaining Muslims. Figure 7 suggest that, even after accounting for pre-expulsion population density and other characteristics, literacy rates among Muslim residents in 1927 are significantly higher in areas with higher Armenian and Greek shares in 1893. One percentage point increase in the historical Armenian (Greek) share is

Table 5 Minorities, Minority Schools and Educational Attainment – District Level Evidence

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) OLS	(8) OLS
Dependent variable: High school completion rate in 2000								
Armenian population share, 1881-1893	0.109***	0.079***	0.059*	0.093***	0.055*	0.040	0.030	0.051*
	(0.030)	(0.025)	(0.034)	(0.030)	(0.028)	(0.027)	(0.030)	(0.029)
Greek population share, 1881-1893	0.107***	0.067**	0.087**	0.093***	0.085***	0.065**	0.072*	0.079**
	(0.030)	(0.030)	(0.038)	(0.032)	(0.032)	(0.032)	(0.036)	(0.032)
Log(Population density, 1927)	0.020***	0.001	0.017***	0.017***	0.006	−0.005	0.005	0.006
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Literacy rate in 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 in 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)	
In central kaza/sancak			0.015***				0.012**	
			(0.005)				(0.006)	

Table 5 (continued)

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) OLS	(8) OLS
Spatially-weighted Muslim exposure to Armenian community				2.808***				2.382***
				(0.597)				(0.502)
Spatially-weighted Muslim exposure to Greek community				0.752*				0.593
				(0.387)				(0.369)
Baseline geographical controls	×	×	×	×	×	×	×	×
Modern sub-region dummies	×	×	×	×	×	×	×	×
All robustness controls					×	×	×	×
Observations	757	757	757	757	757	757	757	757
Adjusted R^2	0.293	0.354	0.322	0.325	0.358	0.398	0.375	0.379
Effect of 10th–90th %ile move in Armenian share/spatial exposure	2.158***	1.563***	1.161*	0.245***	1.084**	0.791	0.595	0.208***
	(0.590)	(0.499)	(0.671)	(0.052)	(0.549)	(0.538)	(0.604)	(0.044)
Effect of 10th–90th %ile move in Greek share/spatial exposure	2.744***	1.718**	2.229**	0.071*	2.191***	1.675**	1.840**	0.056
	(0.762)	(0.759)	(0.971)	(0.037)	(0.827)	(0.825)	(0.929)	(0.035)

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 two alternative proxies for potential historical exposure of Muslim communities to minority human capital. The first proxy is the number of minority school buildings in the district normalized by the size of Muslim community back in 1893. The second proxy is localized measure of minority exposure. To construct it, we first compute for each historical Muslim community building (either a mosque or school) within a district the weighted number of Armenian (or Greek) community buildings within 20 km, using the inverse distance to the minority building as the weighting factor. Then, we average these distance-weighted local exposure measures across all historical Muslim buildings in the district. In all regressions we control for past population density, geographic baseline controls and subregion fixed effects. In addition, in columns (5)–(8) we add all robustness controls introduced previously. The estimated effect associated with increasing minority share (or spatial minority exposure of Muslims in columns 4 and 8) 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 parentheses. *** denotes statistical significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level

associated with a 0.06 (0.05) percentage point increase in literacy rate in 1927. This is economically sizable as the average literacy rate at the time was 5.9%. A move from the 10th to the 90th percentile of the Armenian share raises literacy rate by 1.28 percentage points –more than one fifth of the average literacy rate.

Additionally, Figure 8 shows that the employment shares in commerce in 1927 were also higher in former minority areas. This suggests that Muslim population living in former minority areas were not only more literate but also a greater fraction of this population had the necessary skills and opportunities to be employed in commerce.

5.1.4 Contemporary educational attainment is higher in ex-minority areas and districts with greater stock of historical minority human capital

If the head start in human capital accumulation among Muslims in high-minority regions persisted over time, we should observe today greater education levels in historically high minority areas –with historical human capital mediating this relationship. District-level results in Table 5 support these predictions. Column 1 shows that Armenian and Greek shares in 1893 are positive and significant predictors of greater high school completion rates in 2000.[44] Column 2 suggests that literacy rates in 1927 are a significant predictor of educational attainment in 2000, and once the literacy rates in 1927 are taken into account, the relationship between minority shares and contemporary education becomes weaker.[45] Armenian and Greek coefficients drop by 28 and 38 percent, respectively, upon controlling for literacy rates in 1927 (comparing columns 1 and 2). This suggests that part of the legacy of minorities on current educational attainment is through positive spillovers on historical human capital accumulation among Muslim co-inhabitants –a fact previously documented in Figures 5, 6 and 7.

Second, we probe whether the stock of historical minority human capital explains some of the variation in educational attainment, even conditional on minority population shares. Thus, employing data on historical school buildings of minorities as of 1912 (see Data Appendix), we compute the ratio of the number of Armenian or Greek school buildings within a district to the size of the Muslim population in 1893. This variable proxies the intensity of exposure to minority human capital by an average Muslim individual. Typically, the degree of interaction among ethno-religious groups was greater in more urban centers with more scope for human capital spillovers.[46] Columns 3 and 7 show how modern educational attainment is related to Armenian and Greek schools per Muslim in 1893, separately for historically more urbanized (central Ottoman districts) and less urbanized districts. As expected, minority schools per Muslim positively predict higher contemporary educational attainment in districts that were part of historically more urbanized areas rather than elsewhere.

While the number of minority school buildings in a district (in proportion to Muslim population) can be informative about the overall exposure to minority human capital, it does not take into account the spatial proximity between Muslims and minority groups. All other things equal (including minority shares), scope for inter-group spillovers would

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

[45] Column 2 also controls for the share of 1927 population younger than 13 and female-male ratio to isolate the part of literacy that is not driven by gender gap in education or the age structure of the population.

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

increase with spatial proximity between these groups. Therefore, if historical human capital spillover was an important channel through which minority presence facilitated Muslim human capital accumulation and hence current economic development, we expect to see a positive link between spatial exposure of Muslims to minority groups and contemporary educational attainment, even conditional on overall minority presence in the district. In columns 4 and 8, we test this idea using spatially-weighted measures of Muslim exposure to Armenians and Greeks in each district. To construct the spatial exposure variables, we first use geocoded locations of historical mosques and madrasas as proxies for local centers of Muslim concentration. For each such Muslim building we compute the weighted number of Armenian (Greek) community buildings that fall within a 20km radius. As weights, we use the inverse distance to each such minority building. Then, we average these spatial exposure measures across all Muslim buildings within a district to obtain our final variable. Results suggest that educational attainment is positively related to geographic proximity between Muslim and Armenian (Greek) communities even when we compare districts with similar minority population shares. The estimated marginal effects of exposure to Armenians are larger and more precisely estimated than for Greeks.[47] The latter coefficients are marginally insignificant at conventional levels (p-value=0.11) once all robustness controls are added.

Finally, we provide suggestive evidence, at the district level (see columns 2–5 in Table B.8) and at the village/neighborhood level (see Table B.9), that historical human capital accumulation plays an important intermediating role in explaining the reduced form relationship between local minority presence and economic activity today.

5.1.5 Contemporary occupational structure in ex-minority areas is relatively more skill-intensive and largely coincides with historical Greek and Armenian occupational over-representation

Going beyond broad proxies of human capital, we use the 5% Micro Sample from the 2000 Turkish Census to provide suggestive evidence that the skilled occupations of minorities (see Tables 1 and B.1) were eventually taken up in the post-expulsion era by the Muslims in those areas. Our goal is to explore whether historical minority presence predicts the prevalence of contemporary professions which (i) require higher educational investment or scientific training and/or (ii) can be broadly considered as the modern counterpart –in terms of sector-specific skills– of those occupations in which Greeks and Armenians were dominant or over-represented.

In the micro sample, we observe the *actual profession* category (80 in total) of individuals. We compute district level occupational distribution to capture the type of professional skills acquired through education, training or experience.[48] As such, representation of different groups of professions in the district population reflects the type of human capital of residents. At the modern district level, we regress the share of people in each selected

[47] However, it is hard to conclude much from this comparison since the quality and coverage of data on Armenian and Greek buildings are not comparable.

[48] To make the sample more representative of the occupational composition of long-term residents rather than recent immigrants, we focus on the universe of citizens of Turkey with age 12 or above, who were born in the province where they currently reside, who have been resident in the same district since at least 1995 (five years prior to the Census) and who declared to have a profession.

Table 6 Minority Shares and Modern Occupational Structure in 2000

PANEL A	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	OLS	OLS	OLS
	Agriculture	STEM	Medicine	Entrepreneurs and Directors (excl. trade)	Trade and Commerce
Armenian population share, 1881–1893	−0.364***	0.033***	0.011***	0.006**	0.028***
	(0.082)	(0.009)	(0.003)	(0.003)	(0.008)
Greek population share, 1881–1893	−0.308***	0.024***	0.006**	0.005***	0.033***
	(0.057)	(0.006)	(0.002)	(0.002)	(0.007)
Baseline controls	×	×	×	×	×
Modern sub-region dummies	×	×	×	×	×
Observations	757	757	757	757	757
Adjusted R^2	0.321	0.285	0.170	0.085	0.275
Mean of the outcome	0.692	0.013	0.007	0.003	0.027
Effect of 10th–90th %ile move in Armenian share	−0.401***	0.401***	0.318***	0.260**	0.259***
	(0.090)	(0.112)	(0.081)	(0.114)	(0.076)
Effect of 10th–90th %ile move in Greek share	−0.440***	0.379***	0.211**	0.284***	0.401***
	(0.081)	(0.092)	(0.090)	(0.091)	(0.086)
PANEL B	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	OLS	OLS	OLS
	Carpentry, Masonry and Construction	Jewelry	Glass, Ceramics and Pottery	Instrument/Machine Making and Electronics	Food, Drink and Accommodation
Armenian population share, 1881-1893	0.050**	0.001	−0.000	0.056***	0.000
	(0.023)	(0.001)	(0.002)	(0.014)	(0.002)
Greek population share, 1881-1893	0.023**	0.001**	−0.001	0.041***	0.017**
	(0.011)	(0.001)	(0.002)	(0.008)	(0.007)
Baseline controls	×	×	×	×	×
Modern sub-region dummies	×	×	×	×	×
Observations	757	757	757	757	757

Table 6 (continued)

PANEL B	(1) OLS Carpentry, Masonry and Construction	(2) OLS Jewelry	(3) OLS Glass, Ceramics and Pottery	(4) OLS Instrument/Machine Making and Electronics	(5) OLS Food, Drink and Accommodation
Adjusted R^2	0.152	0.103	0.035	0.338	0.192
Mean of the outcome	0.039	0.001	0.002	0.031	0.005
Effect of 10th–90th %ile move in Armenian share	0.352**	0.108	−0.008	0.393***	0.001
	(0.160)	(0.067)	(0.058)	(0.098)	(0.058)
Effect of 10th–90th %ile move in Greek share	0.206**	0.196**	−0.034	0.370***	0.518**
	(0.100)	(0.080)	(0.096)	(0.069)	(0.233)

This table presents results from the district level regressions of share of people in each selected occupation group in the year 2000 on historical minority shares, controlling for past population density in 1927, geographic baseline controls, subregion fixed effects. 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 in that occupation. Robust standard errors, clustered at the level of modern Turkish province (*il*), are reported in parentheses. *** denotes statistical significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level

occupation group in 2000 on historical Armenian and Greek shares, conditional on baseline controls.[49]

Results are presented in Table 6. Armenians or Greeks were not historically dominant in agriculture. Consistently, column 1 of Panel A suggests that the share of people in agriculture is lower in historical minority areas. Presumably, STEM and medical occupations employ the upper tail of human capital. These people are more prevalent in regions with higher historical minority presence (columns 2 and 3, Panel A) –consistent with the fact that medicine is the only profession where Armenians and Greeks were historically over-represented and dominant vis-a-vis Muslims (Table B.1). In three Ottoman cities of 1840s, manufacturing and trade (sellers and dealers) were two of the most religiously diverse occupation groups (see Panel B in Table 4), where Armenians and Greeks were over-represented (Tables 1 and B.1). Almost 80 years after the expulsions, the shares of entrepreneurs and executives, people in trade and commerce, and manufacturing occupations involving instrument, machine and tool making increase with the concentration of minorities prior to the expulsions (columns 4 and 5 of Panel A and column 4 of Panel B). Professions related to building and construction (including carpentry and masonry) are also more prevalent in ex-minority areas (column 1, Panel B) –consistent with the historical specialization patterns for both ethnoreligious groups. Greeks, and to a lesser extent Armenians, were historically over-represented among jewelers, which is reflected in the share of the local workforce in higher Greek areas (column 2, Panel B). Finally, we find that in ex-Greek locations higher share of people hold professions in services involving food, drink and accommodation (column 5, Panel B), consistently with Greeks' historical over-representation in this service category.

The evidence from this subsection strongly suggests that Armenian and Greek minorities have made a direct contribution to local human capital accumulation among Muslim residents, very likely through pre-expulsion spillovers of occupational skills and knowledge.

5.2 The role of confiscated minority assets

> *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 after the Genocide (6 January 1916).

Part of the properties and assets minorities left behind after the expulsions –e.g., community buildings, land plots, shops and factories– were either plundered by opportunist crowds or unlawfully captured by the local elite. However, a good part of the minority assets were confiscated by the state and sold via public auctions –mostly to the politically

[49] We use the patterns of occupational specialization by Greeks and Armenians that are summarized in Tables 1 and B.1 as a rough guide when deciding which profession groups to focus on as outcome measures.

connected elite (Üngör & Polatel, 2011).[50] Historical accounts suggest that state officials and local notables received a disproportionate share of minority assets –especially after the Armenian expulsions.[51]

Galor and Moav (2004) argue that in the early stages of industrialization, when physical capital accumulation was the prime engine of growth, greater inequality can promote economic growth, although this relationship is eventually reversed when human capital becomes the main driving force behind economic development. It is possible that unequal redistribution of minority property led to greater asset concentration after the expulsions and facilitated the emergence of a Muslim bourgeoisie. Moreover, the concentration of minority wealth in the hands of a local Muslim elite could have spurred investment in more viable businesses and bigger enterprises thereby fueling physical capital accumulation and growth, particularly during the early stages of Turkish industrialization when capital was scarce.

To test this hypothesis, we ideally need historical data that would allow us to compare the distribution of private assets held by Muslims before and after the expulsions and to relate the difference to confiscated minority assets. Unfortunately such data is not available. Instead, we use a contemporary proxy for historical asset concentration. Employing district-level information on land holdings of households in 1997, we construct a Gini index for land holdings.[52] Contemporary land inequality would be a reasonable proxy if asset concentration, spurred by the transfer of minority property, persisted to date. We combine land concentration 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.[53]

The hypothesis we want to test has two parts. The first part postulates that, other things equal, asset inequality should be higher in regions with greater minority presence and higher amount of confiscated property –especially when minority assets were more unequally redistributed. In Table 7 we explore this link. First column suggests that minority shares in the past positively predict modern land inequality. Column 2 shows that although historical Armenian buildings significantly predict greater land concentration in 1997,

[50] On 27 September 1915, Talaat Pasha, then the Minister of Interior and the Minister of Finance of the government, drafted a "temporary law" titled "The law about the abandoned properties, debts and credits of the population who were sent elsewhere". With the directive of this law, special commissions known as the "Abandoned Property Commissions" (Emval-i Metruke Idare Komisyonları) and the "Liquidation Commissions" (Tasfiye Komisyonu) were established. These commissions were tasked with collecting detailed information about the assets of the deportees and assessing their value.

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

[52] Reassuringly, this index is strongly correlated with spatial inequality in night lights (both unconditionally and conditional on baseline controls). However, we prefer to use contemporary land gini as the main dependent variable because it is a less noisy and more direct outcome of the historical distribution of productive assets compared to light inequality.

[53] 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.

Table 7 Transfer of minority assets and contemporary land concentration

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS
Dependent variable: 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)

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 parentheses. *** denotes statistical significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level

there is no significant effect for Greek buildings. This may be due to more uneven redistribution of Armenian assets compared to Greek assets. While Armenian property was more subject to looting and elite capture, the redistribution of Greek property was more systematic and orderly under the control of the state. Previous conclusions carry over in column 3 when both minority shares and minority buildings are included. Columns 4–6 repeat the same analyses controlling for robustness variables. Overall, the results from Table 7 are consistent with the hypothesis that post-expulsion redistribution of Armenian assets increased wealth concentration.

The second part of the hypothesis suggests that the rise in wealth inequality –possibly driven by elite capture of minority assets– facilitated development in the early stages of industrialization. The evidence we can offer about this part of the hypothesis is relatively weaker. Columns 8 and 9 in Table B.8 show that land concentration correlates positively with development even after controlling for population shares of Greeks and Armenians. However, unlike for human capital, we lack historical measures for wealth or land inequality. Therefore, we cannot rule out the role of reverse causation and simultaneity bias in driving this relationship. One could alternatively argue that the amount of productive assets minorities left behind (per Muslim residents) might have contributed to subsequent development regardless of how unequal they were distributed. In columns 6, 7 and 9 of Table B.8 we tackle this possibility but do not find much evidence in favor of it. Our building-based proxies for minority assets per post-expulsion Muslim population have no explanatory power for contemporary development once minority population shares are accounted for.

5.3 Other potential mechanisms and interpretations

5.3.1 Cultural attitudes

Could the effect of exposure to minorities on cultural attitudes explain our results irrespective of human capital spillovers? In reference to the inter-group contact hypothesis, one may argue that exposure to out-group members under the right circumstances may increase inter-group trust and tolerance, and cultivate a universal world view that is more welcoming to different cultures and ideas. In Table B.10, we regress various measures of trust and out-group tolerance on historical minority presence in the district where a respondent resides. We find no evidence that current residents of ex-minority districts have more generalized trust or more trust towards other religions or ethnicities.

5.3.2 Decline in religious diversity due to expulsions

An alternative view may be that ethnoreligious diversity imposed constraints on development in Ottoman regions, and the decline in religious diversity due to expulsions became a positive push to economic development. However, this scenario is hard to reconcile with two observations. First, religiously more diverse regions had higher population density already prior to expulsions (Figure B.2). Second, religiously homogenous regions prior to expulsions remained at least as homogenous as the ex-minority regions after the expulsions. Yet, the former experienced slower population growth than high-minority areas in the post-expulsion period (Figures 2 and B.5).

5.3.3 Location of ancient settlements and urban agglomeration

Since minority presence pre-dates Muslim arrival, it could be that areas minorities settled had more time to develop/urbanize or that these locations became focal for market development. Here the concern is that time since first settlement rather than the characteristics of the early settlers might be driving our results. This logic however ignores the role of feedback effects. Early transition to sedentary life means more time to accumulate location-specific human capital. Nonetheless, in Section C.3, we account for pre-historic settlement patterns in Anatolia using archaeological evidence. Also, to account for historical urban agglomeration, we control for proximity to Muslim buildings in Table 3. This mitigates the concern that both non-Muslims and Muslims cluster in the same areas and we are simply picking up unobserved factors that made these areas attractive. Additionally, Panel B of the same table shows that luminosity around each locality increases with minority presence in the surrounding areas further away from the center, even after controlling for minority presence in the center.

5.3.4 Sorting of high skilled Muslims

Rather than human capital spillovers to native Muslims, one could argue that sorting of skilled Muslim immigrants into high minority areas may drive our findings on education and development. Broadly speaking, this mechanism, albeit more indirect than the spillover channel, can still be interpreted as the legacy of minority presence as long as immigrants select on economic opportunities that were the result of historical minority presence. In that case, we can view this explanation as a special form of historical agglomeration, i.e. path dependence, whose ultimate source is minority presence.

A somewhat different scenario is that expulsions led to vacant land and labor shortages in ex-minority areas. And perhaps, more educated and skilled Muslim migrants settled in those locations and they were better suited to succeed economically than the native Muslims. Yet, it is hard to explain why Muslim immigrants were more skilled than native Muslims who had greater time to accumulate location-specific human capital. To address this issue, in Table C.1 we account for inflows of immigrants who arrived during the population exchange with Greece and the fraction of population (in 1927) who were born outside Turkey. While we do not observe and hence cannot account for internal migration and its effect on human capital composition during the post-expulsion period, this scenario by itself cannot explain why occupations where Greeks and Armenians were traditionally overrepresented are still more prevalent in ex-minority areas (see Table 6).

6 Concluding remarks

This paper studies the long-run economic legacy of highly-skilled minorities and the channels of persistence long after those minorities were expelled en masse. To do so, we exploit the mass expulsions of Armenians and Greeks of the Ottoman Empire in the early 20th century as major quasi-natural experiments of history.

We offer evidence that the mass expulsions did not completely erase the influence of Armenian and Greek communities on regional development. We find that, in modern day Turkey, districts with greater presence of Armenians and Greeks about a century ago are

more densely populated, more urbanized, and more developed. Using a large sample of villages and neighborhoods in Turkey, we also establish a strong legacy of minority settlements on the current distribution of luminosity at a very granular level. The estimates are sizable and unlikely to be driven by endogenous selection.

We provide evidence on the channels through which Armenian and Greek presence might have shaped regional outcomes. We show that Muslim co-inhabitants benefited from greater exposure to Greek and Armenian human capital due to transfer of skills and knowledge. Muslims in high minority regions had greater human capital in the past and still have today, and this, in turn, positively contributes to current economic activity. We also explore the intermediating role of minority assets that were confiscated in the aftermath of the expulsions. We find some evidence 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.

Our results bear significance beyond its particular context. They suggest that population geography of the past can shape the geography of economic activity in a long-lasting way. Specifically, not only the ancestral heritage of *current* populations –a subject that received much attention in the deep-roots literature– but also the heritage of the groups that are long gone can leave a strong imprint on the spatial pattern of economic development. Therefore, a general lesson from our study is that ignoring the persistent "legacy effect" of past populations may lead to misleading conclusions about the effect of contemporary population geography. Constructing a new measure of ancestral heritage that also accounts for historical experience of groups that are no longer present might be a challenging but fruitful direction for future research.

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Authors and Affiliations

Cemal Eren Arbatlı[1] · Gunes Gokmen[2]

✉ Gunes Gokmen
gunes.gokmen@nek.lu.se

Cemal Eren Arbatlı
earbatli@gmail.com; darbatli@hse.ru

[1] Faculty of Economic Sciences, HSE University, 11 Pokrovsky Boulevard, Moscow, Russia

[2] Department of Economics, Lund University, Lund, Sweden