# Improve Education Opportunities for Better Integration of Syrian Refugees in Turkey

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## Abstract

The integration of Syrian refugees in the Turkish society is crucial for the long-term well-being of both populations. Education is one of the most important element to integrate Syrians' children and prevent a "*lost generation*". In this project, we investigate two main aspects related to refugees' education: "How to improve Syrians' access to schooling?" and "What is the impact of Syrians' schooling on Turkish society?" The analysis presented in the paper provides quantitative elements to analyze and optimize education resources with respect to refugees' and natives' needs, supporting the claim that education plays a key role in improving integration in the society.

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## 19.1 Introduction

Turkey is the largest refugee-hosting country worldwide with 3.5M registered Syrian refugees. Most of these refugees will not return to Syria anytime soon. According to a recent research documenting the extent of economic destruction in Syria, more than 50% of Syrian economy got destroyed, which means that economic returns to going back to Syria are almost zero [4]. Considering that Syrians will continue to live in Turkey for many years, and that a significant portion will not turn back to their country, their integration in the Turkish society is crucial.

As more than one-third of the Syrian population residing in Turkey is composed of school-age children, schooling and education have a major role in the integration process. Schooling has a fundamental role to normalize the lives of children, to support their interactions with peers (Syrians and Turkish), and to provide them with the skills for their future professions. When children are left out of education, they are prevented from escaping poverty and become more vulnerable to ghettoization and radicalization. Education of Syrian children is fundamental for both those who will stay in Turkey and for

those who will eventually return to Syria. The former will contribute economically, socially, and culturally to Turkish society, the latter will rebuild their country with the education they received in Turkey. "*In this sense, education is an important soft power strategy*" [7]. However, from the perspective of any hosting society, mass refugees inflow represents a huge challenge. Refugees generate competition for several resources and many public services get congested. This congestion creates conflicts and one of the major conflict area is "education". Host countries have limited education resources (schools and teachers), which makes policy-making and resource reallocation a major issue.

One of the main assets to address these complex challenges is to have up-to-date fine-grained information about refugees and their activities. Mobile phone data (i.e., Call Detail Records (CDRs) [16]) allows to track activities of refugees and natives at a fine-grained scale, therefore it is a natural response to this need for information. Mobile phone data has been used to estimate the socioeconomic status of territories [11, 14] and individuals [2], to analyze the dynamics of cities [8], to model the spreading of diseases [20], and to predict crime levels [3].

In this project, we will use mobile phone data to analyze some of the challenges to integrate Syrian refugees in the Turkish education system and the impact on the Turkish society. Educational institutions do not simply transmit human capital, they also pass on social capital in the form of social rules and norms. So, investments in education will not only work toward increasing Syrians' school enrolment rate, they will also impact their integration in the society. Our goal is to propose some new findings and recommendations along this dimension:

1. 1.

   We analyze the distribution of refugees across the country and their possible impact on education facilities. We analyze logistic obstructions to schooling of Syrian children, and propose and evaluate an optimization mechanism to identify areas where new education resources are required considering the needs of both refugees and natives.

2. 2.

   We analyze the relationship between education and social integration. We analyze the impact of Syrian refugees' schooling on social integration (measured via numbers of calls between natives and Syrians). We analyze the impact of Syrian refugees on the education choices of natives and their impact on Turkish economic development.

Overall, our purpose is to develop evidence-based research with outputs directly implementable by policymakers.

## 19.2 Background on the Education of Syrian Refugees

Providing accurate figures about Syrian refugees' education is a challenging task. On the one hand, the number of refugees is constantly increasing (in 2017 alone it grew by 20%), on the other hand, policies and applications about Syrians' education are changing frequently. Because of this, analyses and reports on Syrians' education in Turkey quickly lose their currency (this is a strong reason for the need of innovative information sources, like mobile phone data). Nevertheless, as a general background, we report some data from existing documents [5, 6, 7].

There are about 3.5M registered Syrian refugees in Turkey. About 8% of Syrian refugees live in one of the 23 Temporary Sheltering Centers (TSCs) across the country. The remaining 92% live in cities. Among them, more than 1M are school-age children. Thanks to the efforts of Turkey and of the international community, the number of Syrian refugees regularly attending primary education rose from about 25% in 2016 [5], 55% in 2017 [7], and 63% in 2018.[1] Despite this notable increase, the situation is far from solved. Prior to the conflict, the primary school enrolment rate in Syria was 99% and lower secondary school enrolment was 82%, with high gender parity.

Syrian refugees' education could be attained in public schools (about 65,000 schools) and in Temporary Education Centers (TECs): private schools typically run by Syrian charities and offering courses in Arabic and intensive Turkish language courses (about 400 TECs—serving about 230K students). However, in 2017, in an attempt to better integrate Syrian kids in the education system of public schools, the Ministry of National Education (MoNE) has decided to start the closing of the TECs. Therefore, while in 2016, 80% of Syrians preferred to study at TECs, since the beginning of the 2016–2017 academic year, MoNE has put a halt to new registrations to preschools as well as to the 1st, 5th, and 9th grade at the TECs (Turkish school system is termed *4+4+4*: 4 years primary education, first level, 4 years primary education, second level, and 4 years secondary education). The newcomers to these grades are now directed to public schools (provided they have sufficient Turkish language skills). In 2017, about 50% of schooled Syrians went to TECs and 50% to public schools.

## 19.2.1 Congestion of Education Resources

Turkey faces many issues in taking care of the education of Syrian children. First of all, cities like Sanliurfa, Gaziantep, and Istanbul—where most of the Syrians live – had already issues regarding the educational infrastructure. The number of students per teacher and per classroom in these cities are above the average of Turkey. In addition, 19% of the primary schools in Turkey have double-shift education[2] and 46% of students study at these schools. 65% of primary school students in Gaziantep, Adana and Bursa and 55–64% of students in cities like Istanbul, Ankara, Izmir, Sanliurfa, Mersin, and Osmaniye are educated at schools with the double-shift system. Cities with high population of Syrians are at the same time the cities where schools have many troubles and where double-shift education is a common phenomenon. The current plan to close down TECs (although well justified to improve integration) will worsen the situation. For this reason, physical capacities of public schools that Syrians will be directed to in the case of closures of TECs must be assessed carefully and eventually new resources should be directed to congested areas. As stated in the Introduction, correctly addressing this congestion problem is fundamental to improve integration and acceptance of Syrians in Turkish society.

## 19.2.2 Obstructions and Mobility

Although important results have been already achieved, an important challenge faced by Turkey is to increase Syrians' school enrolment rate. While the two most prominent obstructions to schooling are economic issues (children work to support their family), and language barrier (e.g., inability to understand courses, feeling of alienation in the school environment, concern about forgetting Arabic), in this section, we focus on another important obstruction that is directly related and measurable with mobile phone data: transportation and mobility.

An important obstructions to the access of Syrian children to education is the distance between the homes of the kids and schools. Syrians usually live in the poorest neighborhoods and near the industrial zones where even the locals have issues accessing education and urban life. The fact that some schools start at later hours force children being on the road after the dark. As the majority of Syrian students do not have the economic means to buy service from private transportation companies, this causes some

families to avoid sending their children (daughters especially) to school. Another factor in keeping children out of school is the high mobility rates in the lives of Syrians. It was observed that the majority of unschooled children in Istanbul and Ankara just migrated to these cities from southern provinces. As Syrian families continuously move between the cities and relocate frequently, absenteeism becomes an inevitable consequence.

In general, when planning new education resources, these logistic obstructions together with the above congestion problems must be taken into account.

### 19.2.3 Ongoing Activities

There are several studies and ongoing activities to improve Syrians education in Turkey and reduce congestion on existing resources. Among them, the PICTES Project (Promoting Integration of Syrian Children to Turkish Education System) is one of the largest initiatives. It is a 500M Euro project between Turkey, EU, Kreditanstalt für Wiederaufbau and the World Bank to support integration and education activities [6]. The project is implemented in 23 provinces where the population of Syrians under temporary protection is the largest. The project includes school constructions (about 200M Euros), transportation services (about 30M), and many other activities (e.g., teaching Turkish, Arabic language training, remedial/catch-up courses, educational materials).

Providing reliable and timely data on Syrian refugees' locations and activities is critical to support planning and decision making in these projects.

## 19.3 Materials and Methods

The D4R initiative provides a unique dataset to analyze the behavior of Syrian refugees at a fine-grained scale [16]. In this section, we describe the main information extracted from these data and used in our work.

- Dataset 1 (Antenna Traffic) provides site-to-site traffic (aggregated CDRs) on an hourly basis. Following [17, 18], we extracted several features associated to these data ranging from simple aggregations to graph-based metrics describing the connectivity graph across multiple regions. In general, we use these data as a proxy for Syrian refugees' location and activities.

- Dataset 2 (Fine-Grained Mobility) provides detailed (BTS-level) information about calls and SMS made by a random sample of active users (individual CDRs). We use this dataset for two main purposes: on the one hand, it allows to precisely identify the home (primary) location of the sample of users [13] and to analyze those locations in relation with schools around. On the other hand, these data allow to measure for each user the number of calls/SMS placed to other Syrians and/or to other Turkish people. Aggregating the number of calls between Syrian–Syrian, Syrian–Turkish, Turkish–Turkish, we can get information on the social integration in the random sample.

- Dataset 3 (Coarse Grained Mobility) provides coarse (District level) information about calls and SMS made by a random sample of active users (individual CDRs). We used these data to analyze large-scale mobility behavior and relocations of Syrian refugees across the country.

In addition to D4R data, we got access to the following data sources:

- **Population and School Enrolment**. Data from Turkstat and UNHCR about the distribution of Syrians and natives across the country. Data are divided also by gender and age group. In particular, we obtained fine-grained location data about the education choices of Turkish natives. For each district, we have the number of male and female students attending primary, secondary, high school, university, master, and doctorate schools. Critically, we did not get access to the same information for Syrian refugees. However, we obtained from [5] data about province-level distribution of the number of Syrians attending public schools and temporary education centers (TECs) in 2016.

- **Education Resources**. Data from Ministry of National Education (MoNE) about the distribution of public schools by district and type (preschools, primary schools, and high schools). Data about province-level distribution of TECs in 2016. We extracted these data from [5]. Data from Open Street Map (OSM) containing the exact locations of a sample of about 7,000 schools (1034 in Ankara, 642 in Kayseri, 621 in Istanbul, 547 Konya, etc.)

- **Economic Indicators**. Data about province-level per-capita GDP from 2004 to 2014 from Turkstat. Data about district-level per-capita GDP from 2014 to 2017 proxied by the analysis of satellite night-lights from NOAA VIIRS/DNB dataset.[3]

Data analysis has been conducted with standard statistical techniques (summary statistics and OLS) favoring interpretability of the results. In the following section, we describe data analysis and experiments in detail.

# 19.4 Research Questions and Experiments

In this project, we investigate a number of important aspects related to the situation of the refugees in terms of education: education access, logistic obstructions to schooling, congestion in access to education resources, the impact on natives' education choices, the relationship between education, and social integration and well-being. We organize the section in a preliminary analysis on the representativeness of the data which is in itself an important issue (Research question 1) and then we tackle two main research question more specifically related to the issue of education (Research questions 2 and 3).

**Research Questions**

1. 1.

   **Does mobile phone data reflect the distribution of refugees across the country?**

2. 2.

   **How to improve Syrians' access to schooling?**

   - What are the main logistic obstructions for Syrian refugees' schooling?

   - Can we identify areas in which education resources are particularly congested?

   - Can we use this information to prioritize the construction of new education resources?

**What is the impact of Syrians' schooling on Turkish society?**

- ○ Does schooling and education have an impact on social integration?

- ○ Does refugees influx have an impact on natives' education choices?

- ○ Does integration and education have an impact on economic well-being?

Data-driven research addressing these questions can provide critical information to help policymakers enact more effective interventions.
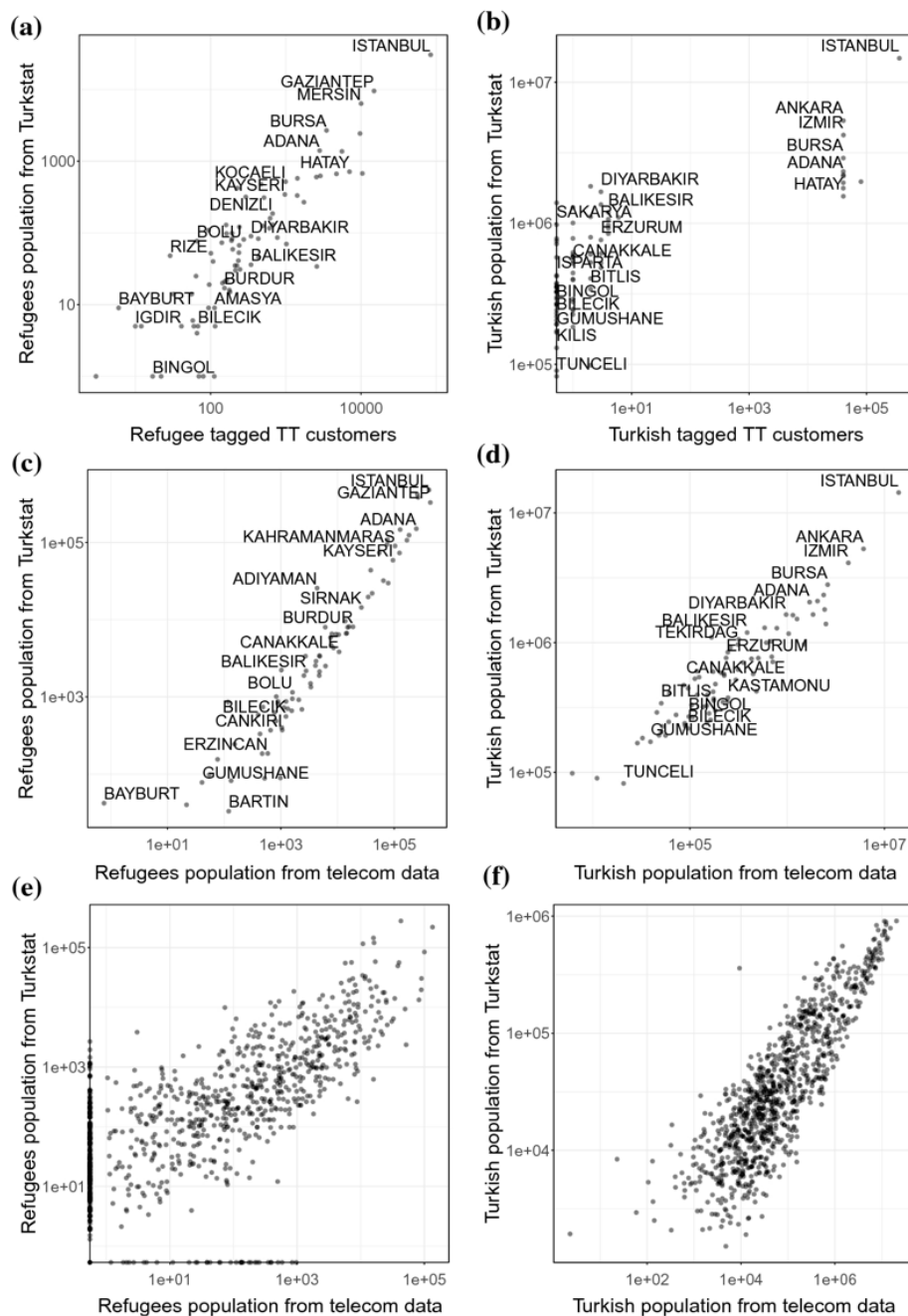


Fig. 19.1

**a, b** Province-level correlation between Türk Telecom refugees and natives in D4R dataset and from Turkstat. **c, d** Province-level correlation between refugees/natives population from telecom data and from Turkstat. **e, f** District-level correlation between refugees/natives population from telecom data and from Turkstat
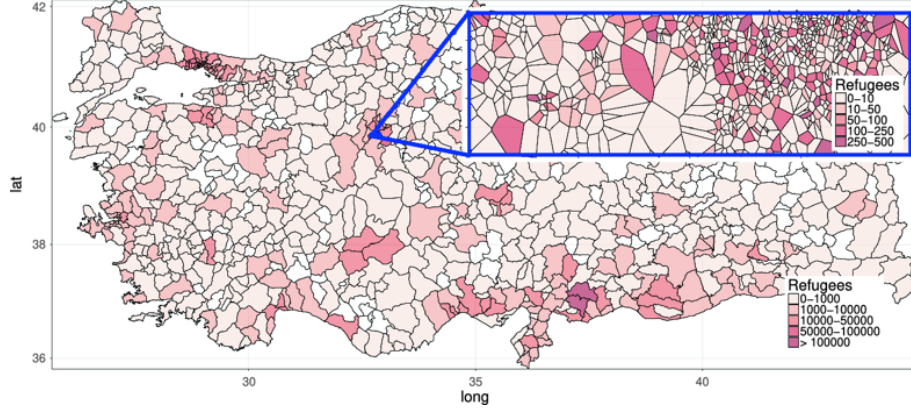
Fig. 19.2

Refugees' density across the country. The inset shows a BTS resolution map obtained by a Voronoi tessellation of the telecom antennas. In the city centers, Voronoi regions are typically smaller than 500 m²

## 19.4.1 Does Mobile Phone Data Reflects the Distribution of Refugees and Natives Across the Country?

This introductory question is intended to understand the representativeness of the data and to analyze its main biases. As described in [16], D4R dataset is collected from 992K Türk Telecom customers, of which 185K are tagged as refugees and 807K as Turkish citizens. D4R data contains also the province-level distribution of these Türk Telecom customers. The Turkish citizens have been sampled mainly for the cities with high-presence of registered refugees, so they do not reflect the distribution of citizens across the country. Figure 19.1a, b shows correlation, at the province level (NUTS-3 regions, where NUTS stands for Nomenclature of Territorial Units for Statistics), of sampled Türk Telecom data (refugees and natives) and estimates from official statistics considering March 2017 (the number of Syrian refugees in Turkey in 2017 grow by 20%, so the monthly analysis can provide more accurate figures). While there is a good correlation between refugees' distributions, it is possible to see the sample bias for citizens, exhibiting a bi-modal distribution with low-sampled and high-sampled provinces.

From these data, we computed the Türk Telecom province-level market-share associated with the sampled users: for each province, we divided the number of sampled Türk Telecom customers (refugees and natives) by the corresponding Turkstat data. Of course, this ratio is much lower than the true market-share as it reflects only the sampled users.

To estimate the presence of people on the basis of mobile phone data, we analyzed monthly-aggregate outgoing call volume. Outgoing call volume has been used in previous work as a proxy for the presence of people [9, 10]. For each province, monthly-aggregate outgoing call volume has been scaled according to (i.e., divided by) the computed province-level market-share. This process should compensate biases in the sampling process of Türk Telecom customers. We fitted a linear regression between aggregate outgoing call volume from telecom data (scaled by province-level market-share) and Turkstat data and used the regressed value as a population estimate. In the case of Turkish population, we fit two regressions: one for high-sampled provinces (right cluster in Fig. 19.1b) and one for low-sampled provinces.

Figure 19.1c, d, shows the correlation, at the province (NUTS-3 regions) level, between refugees/turkish estimate from telecom data and from Turkstat ($\rho = 0.94$ for refugees, $\rho = 0.98$ for turkish). Figure 19.1e, f, shows the correlation, at the district (local administrative unit—LAU regions) level, between refugees/turkish estimate from telecom data and from Turkstat ($\rho = 0.68$ for refugees, $\rho = 0.88$ for turkish).

It is important to remark that the non-perfect correlation, especially between refugees from telecom data and from Turkstat at the district level is not necessarily a limit of telecom data. It might be the case that Turkstat data do not accurately reflect the presence of refugees at the district level, therefore, the use of telecom data in this domain is exactly aimed at improving over existing information.

It is also interesting to notice that the correction for (sample-based) market-share allows to efficiently correct biases in the sampling process. Nevertheless, the small sample of natives for some provinces might still bias further analysis. Therefore, in the following, we often use mobile phone data to analyze refugees' distribution while we revert to official statistics for natives. On the basis of these results, we can create fine-grained maps of areas attended by refugees. Considering a Voronoi tessellation of cell network's antennas (BTS), we can create maps at a much finer resolution than districts—LAU regions. In the city centers, Voronoi regions are typically smaller than 500 m$^2$. See Fig. 19.2.

### 19.4.1.1 Discussion

Overall, mobile phone data, once corrected for sample bias, well reflects the distribution of refugees and natives across the country. We speculate that refugees' distribution at the district level computed from mobile phone data can be more accurate than official statistics and that the non-perfect correlation between telecom and Turkstat data can be ascribed to this fact.

## 19.4.2 How to Improve Syrians' Access to Schooling?

### 19.4.2.1 What are the Main Logistic Obstructions for Syrian Refugees' Schooling?

A number of reports and surveys [5, 6, 7] indicates that the sheer distance to school is an important obstruction for Syrian refugees' schooling. We performed an experimental analysis to understand which are the most disadvantaged areas with respect to this dimension.
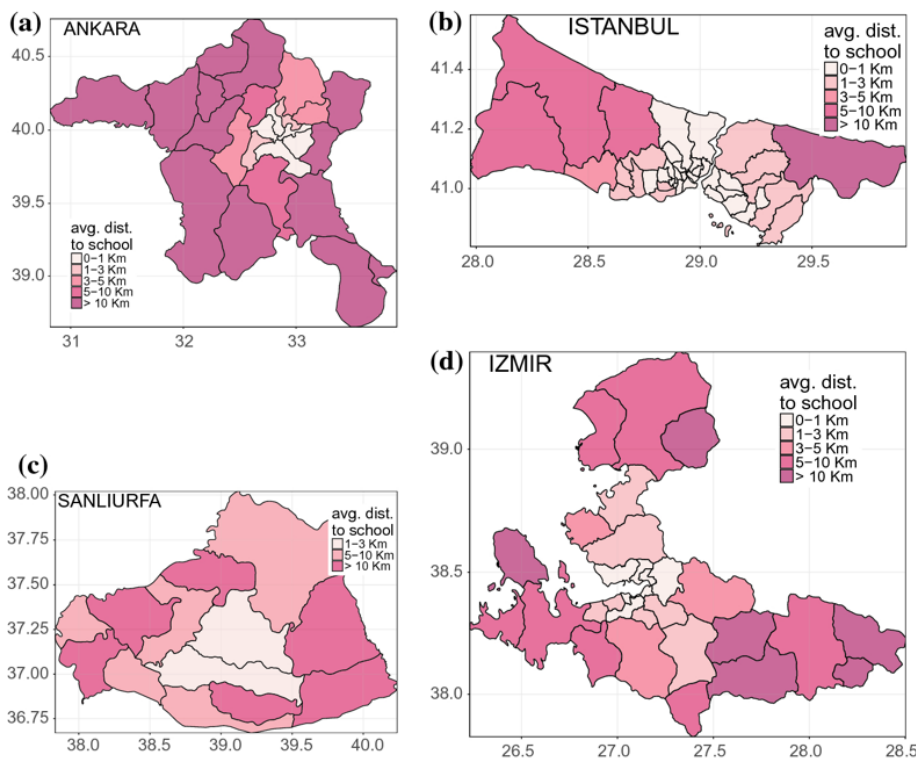


Fig. 19.3

Average distance between Syrian refugees "living" in a given district and closest schools. **a** Ankara province (1034 schools in OSM db). **b** Istanbul province (621 schools in OSM db). **c** Sanliurfa province (122 schools in OSM db). **d** Izmir province (431 schools in OSM db)

We downloaded from Open Street Map (OSM) the location of 7K school buildings in Turkey. From D4R Dataset-2 we find the location where each refugee "lives", by computing the average location of his/her calls and SMS.

For each district, we then computed the average distance between refugees whose main location is in the district and the closest school. More specifically, given $N$ refugees $R_{1...N}$ living at coordinates $(r_{ix}, r_{iy})$ and $M$ schools $S_{1...M}$ at coordinates $(s_{ix}, s_{iy})$, we first compute, for each refugee $R_i$, the closest school:

$S_{R_i} = argmin_j \, dist((r_{ix}, r_{iy}), (s_{ix}, s_{iy}))$ . Then:

$$avg. \; dist. \; to \; school = \frac{1}{N} \sum_{i=1}^{N} dist((r_{ix}, r_{iy}), (s_{R_ix}, s_{R_iy}))$$

In Fig. 19.3, we present results for the different provinces. The maps show the average distance between Syrian refugees "living" in a given district and closest schools. It is important to remark that, on the one hand, this estimate represents a best-case scenario where a student can attend the closest school available. We did not have information about the capacity in terms of number of seats for each school. On the other hand, the OSM database has a limited coverage and not all the schools are mapped. Nevertheless, these maps can indicate disadvantaged areas with respect to schools' reachability. In our future work, we plan to refine this analysis by comparing male and female Syrian student populations, as this obstruction, which is linked to the perception of "safety" getting to and from school, is particularly limiting girls participation in education.

High mobility rates in the lives of Syrians are another obstruction to schooling, as described in [5, 6, 7]. For example, the majority of unschooled children in Istanbul and Ankara just migrated to these cities from southern provinces. To understand Syrians' refugee mobility, we focused on Dataset 3 considering the whole observation period (1 year). We computed the following three mobility indicators:

- Radius of gyration, that is a synthetic and easy-to-compute parameter describing the spatial extent of user traces. It is defined as the deviation of user positions from the corresponding centroid position. It is given by: $r_g = \sqrt{\frac{1}{n} \sum_{i=1}^{n} (p_i - p_{centroid})^2}$ , where $p_i = (x_i, y_i)$ represents the $i$th position recorded for the user and $p_{centriod} = (r_x, r_y)$ is the center of mass of the user's recorded displacements obtained by $p_{centroid} = \frac{1}{n} \sum_{i=1}^{n} (p_i)$

- The distribution of the number of unique provinces and districts visited by refugees

- The distribution of the number of unique "home" provinces and districts of refugees. For each month, we computed the "home" province and district of each refugee as the one where they spent more time. This is different from the above distribution as a person can have a stable primary "home" province and district while visiting and commuting across many. A change in "home" provinces and districts indicates that the person has probably relocated to the new area.

The distribution of the radius of gyration reveals that the vast majority of Syrian refugees live in a well-defined area (80th percentile = 30 Km). However, there is a long tail of refugees spanning larger distances (95 percentile = 250 Km). Figure 19.4a shows the distribution of all visited provinces and districts: 77% of Syrian visit more than one province, 99% of Syrian visit more than one district. Figure 19.4b shows the distribution of home provinces and districts: 28% of Syrians have more than one home province. 54% of

Syrians have more than one home district. Under our assumptions and according to D4R data, this means that about one-third of Syrians have changed province of residency in 2017.

### 19.4.2.2 Discussion

Mobile phone data allow us to quantify logistic obstructions to schooling. It is possible to see that in all provinces there are disadvantaged districts where the average distance to the closest school is large (5Km or even more). In the lack of affordable and safe transportation and considering the late hours at school (due to double-shift system) for a large number of Syrian refugees, this kind of distances represent an important obstruction to schooling. In addition, a sizable number of Syrian refugees move in a wide area (5% move further than 250 Km). Moreover, it seems that about one-third of Syrians have changed province of residency in 2017. Indeed mobility and relocations among provinces can be an obstruction for school planning of Syrian children.
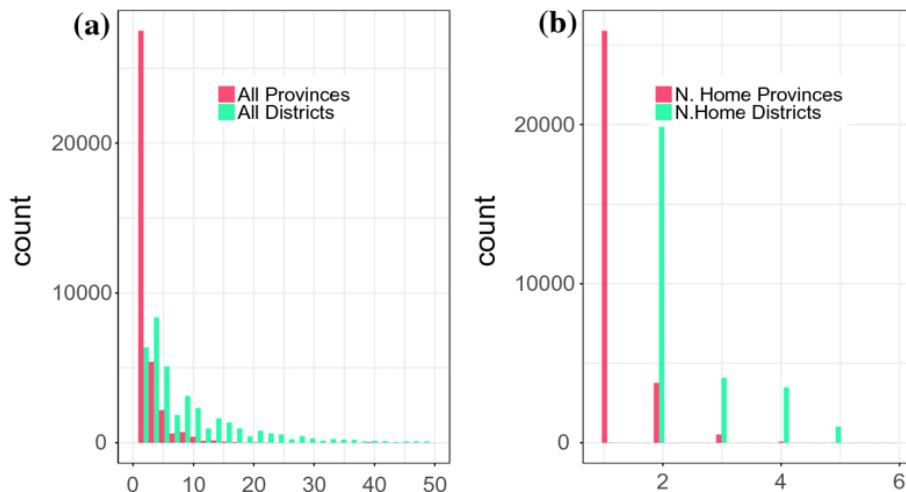


Fig. 19.4

**a** Distribution of all visited provinces and districts. **b** Distribution of home provinces and districts

### 19.4.2.3 Can We Identify Areas in Which Education Resources Are Congested and Prioritize New Education Resources Accordingly?

From the perspective of any hosting society, mass refugees inflow represents a huge challenge. Refugees generate competition for several resources including education. Identifying congested areas and allocating education resources is a valuable process to ease conflict between natives and refugees, and to support refugees' education and integration. Moreover, given that the distance to school is an important obstruction to schooling, a natural remedy is to build or potentiate schools to improve reachability by refugees. There are indeed initiatives in this direction, for example, the PICTES Project allocates 200 million Euros to school construction.

A concrete use of mobile phone data is to use fine-grained data about refugees' locations to support decision-makers on where to create new education facilities taking into account both natives' and refugees' needs. We envisioned a simple procedure that, taking into account both natives' and Syrian refugees' needs, identifies provinces and districts where the education resources are most congested. Then, focusing on a specific district, it identifies areas where to build new schools or potentiate existing ones with the goal of minimizing travel distance for refugees. We are perfectly aware that the process of creating schools and allocating resources is a complex operation involving many factors (political, economic) outside our data. We do not think that our procedure *per-se* can be a valid decision-support tool. However, it could enrich existing planning solutions.

We can compute a simple congestion metric for education resources at the province/district level as the ratio between the number of children (both Turkish and Syrians) and the number of schools in the area. Unfortunately, we do not have data about school capacity and number of teachers that would notably improve the estimate. We obtained the number of Turkish children and the number of schools directly from Turkstat and MoNE. The number of Syrian children has been obtained from mobile phone data by scaling the total number of Syrians by the ratio of children across Syrians' population (44% from UNHCR[4]).

The results are depicted in Fig. 19.5a, b, at the province-level, and in Fig. 19.5c at the district level (focusing on the Ankara province).

Given a budget of $X$ schools to build, we can simply allocate $X_i$ schools to province $F_i$ proportionally to the education resources' congestion $C_i$ in that province. Table 19.1 shows the result of an experiment to allocate 75 new schools across the country. The column "New School" is the number of schools to build in each province according to the above proportional criteria. For comparison, we obtained, from [6], data about the construction of 75 new schools by the PICTES project (that we consider a sort of optimal allocation). The two columns have Spearman rank correlation of 0.8, p-value $\approx$ 0.

The same mechanism can be applied at the district level. For example, focusing on Ankara, our approach would allocate the three schools to build in the district of Altindag. Interestingly enough, also the six schools that PICTES is building in Ankara are all in the Altindag district.[5]
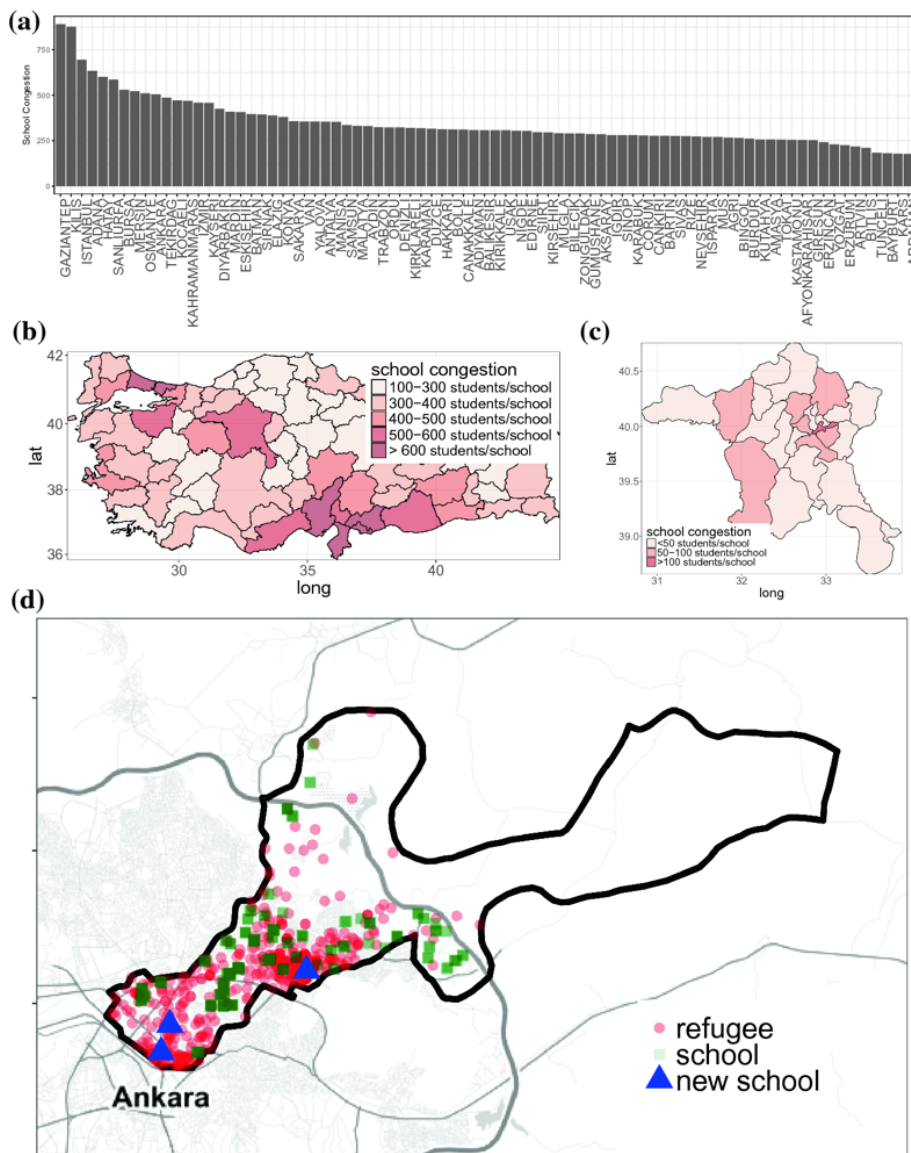


Fig. 19.5

**Table 19.1**

New school allocation by our approach and PICTES project

| Province | New Schools | PICTES |
|---|---|---|
| Gaziantep | 7.00 | 5.00 |
| Kilis | 7.00 | 6.00 |
| Istanbul | 7.00 | 6.00 |
| Adana | 4.00 | 6.00 |
| Hatay | 4.00 | 5.00 |
| Sanliurfa | 4.00 | 6.00 |
| Bursa | 3.00 | 6.00 |
| Mersin | 3.00 | 5.00 |
| Tekirdag | 3.00 | 0.00 |
| Ankara | 3.00 | 6.00 |
| Osmaniye | 3.00 | 1.00 |
| Diyarbakir | 2.00 | 2.00 |
| Eskisehir | 2.00 | 0.00 |
| Izmir | 2.00 | 4.00 |
| Kayseri | 2.00 | 1.00 |
| Kahramanmaras | 2.00 | 5.00 |
| Mardin | 2.00 | 5.00 |

Finally, we can try to identify the exact location where to build a school by minimizing the distance that Syrian refugees have to travel to reach the closest school (this to tackle one of the main logistic obstruction discussed before). More specifically, a school S to be built in district $D$ is set at coordinates $(s_x, s_y)$, so that the distance between refugees $R_{1\ldots N}$ living at coordinates $(r_{ix}, r_{iy})$ is minimized:

$$(s_x, s_y) = argmin_{x,y} \frac{1}{N} \sum_{i=1}^{N} dist(x, y, r_{ix}, r_{iy})$$

An exemplary result of this allocation is in Fig. 19.5c, where Syrian refugees' main locations are represented by red circles, existing schools by green squares, and the location of new schools to be built by blue triangles.

### 19.4.2.4 Discussion

Mobile phone data allows to precisely localize refugees' whereabouts across the country. This—together with natives' population statistics—allows to better estimate the *demand* for education resources and to compute fine-grained congestion maps to pinpoint the most stressed areas. This kind of information is an important asset to optimize education resources. Of course, congestion maps could be notably improved via better information about school type, their capacity, and the number of available teachers. For example, there is a recent discussion in Turkey on the lack of enough demand for certain types of schools (e.g., Imam Hatip High Schools—religious schools), so some of the results could be reverted considering those schools. In general, data-driven allocation results of (education) resources, like the ones presented, can provide useful information and guidelines to policymakers [1].

## 19.4.3 What is the Impact of Syrians' Schooling on Turkish Society?

In addition to the above issues about refugees access to education, it is very important to analyze the impact of refugees' influx on the Turkish society and how education impacts social integration of Syrian refugees. As Syrians' access to education is constantly improving, the focus should gradually shift to the wider perspective of integration through education.
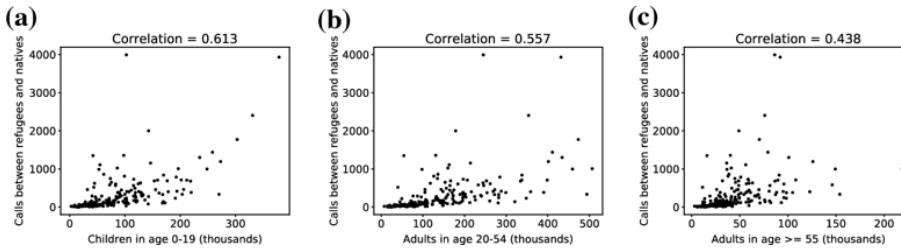


Fig. 19.6

Correlation between the total number of children (**a**), adults (**b**) and seniors (**c**), and the total number of calls between natives and refugees. Data are for a single month (one point is one district), but identical trends hold for different months, as well as for SMS rather than calls

### 19.4.3.1 Does Schooling and Education have an Impact on Social Integration?

To address this question, we take into account the total number of calls and SMS that are exchanged between natives and refugees (both incoming and outgoing). This information can be extracted from Dataset 2 where information about both communication end-points are provided. We named those variables $x2y_{calls}$ and $x2y_{sms}$. Such quantities are highly indicative of the level of integration between the two parts of the population. We compute Pearson's correlation between the total number of people in different age intervals (we obtained these data from Turkstat), and quantities $x2y_{calls}$ and $x2y_{sms}$ aggregated at the district level. In particular, we distinguish between children (age 0–19), adults (age 20–54), and seniors (age $\geq$ 55) and assume that these numbers reflect the distribution of both natives *and* Syrians. An example of the results obtained is shown in Fig. 19.6: clearly, for all age categories, the correlation is positive (the higher the number of people, the higher the number of calls) but for the category of children it results to be significantly higher (

$p < 0.01$ according to a Wilcoxon paired test computed over months). Although our analysis does not support causal claims, this fact suggests that children are an important vehicle for integration between Syrians and natives. In the context of education, results might suggest that building new schools (and addressing the congestion problem described above) can be an appropriate tool to attract more children, and hence to promote integration. In addition, we related $x2y_{calls}$ with the total number of Syrians present in TECs or public schools, respectively. Integration through public education appears to be very effective: a correlation coefficient equal to 0.3 in the case of TECs grows up to 0.7 when considering Syrians educated in public schools (see Fig. 19.7).
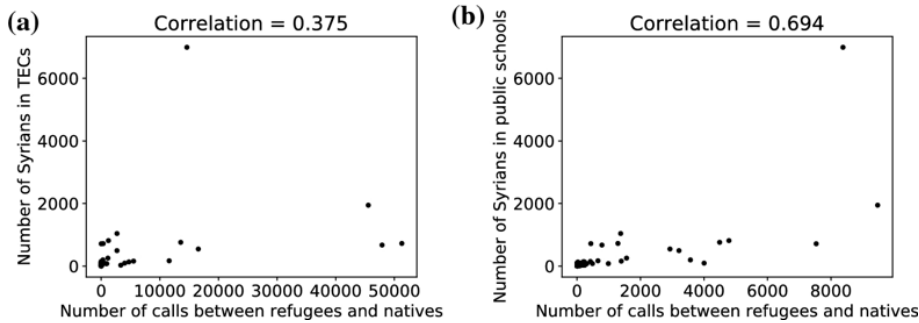


Fig. 19.7

Correlation between the total number of Syrians in TECs (**a**) or public schools (**b**) with respect to the total number of calls between natives and refugees

### 19.4.3.2 Discussion

Education has an important role in supporting the social integration of Syrians' refugees. On the one hand, the presence of children is positively correlated with Turkish-to-Syrian interactions (x2y). Therefore, building new schools can be an appropriate tool to attract more children, and hence to promote integration in the area. On the other hand, these data show that education in public schools over temporary education centers (TECs) improve integration, in agreement with recent policies by the Turkish Ministry of National Education.
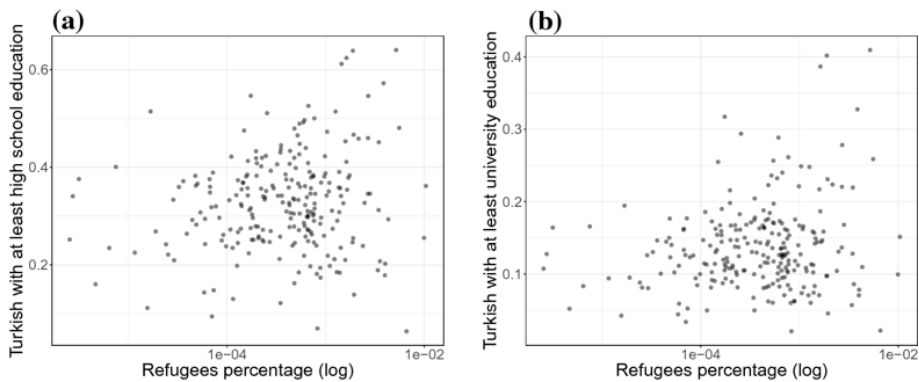


Fig. 19.8

Correlation between refugees percentage and natives' schooling level. **a** High school. **b** University

### 19.4.3.3 What is the Impact of Syrian Refugees on Natives' Education Choices?

Another important aspect to consider is the impact of the influx of refugees on the education choices of natives. The existence of Syrian refugees as a competitor in the labor market also affects the long-term educational behavior of native children. Given that refugees are mostly employed informally in low-skill jobs, returns to low-skill employment will be low in Turkey in the near future. This observation may generate a substantial structural change in the schooling decisions of the youths in Turkey. A recent article [19] ascribes to Syrian influx a 4% increase in high-school enrolment of Turkish youths,

especially from lower parental backgrounds. So, the Syrian refugee crisis affects the educational outcomes of both natives and refugees, which will have important consequences on the long-term human capital capacity of both groups.

To address this question, we analyzed the correlation between the percentage of Syrian refugees and the percentage of Turkish natives who attained a certain level of schooling (high school, university). Results are in Fig. 19.8. High school $\rho = 0.14$, p-value = 0.001. University $\rho = 0.19$, p-value = 0.001. We can see a positive correlation between schooling level and refugees' presence.

### 19.4.3.4 Discussion

Schooling level of Turkish youths seems positively correlated with the presence of refugees. As returns to low-skill employment diminishes, Turkish youths, especially males from lower parental backgrounds, try to improve their education in order to shoot for better jobs. Despite the general appreciation for higher education, this trend can be at the root of two main drawbacks. On the one hand, this "surplus" of students tends to enroll in low-quality high schools. Therefore, the country will have a higher stock of "low-ability" youths with general high school education [19]. This may exacerbate the youth's unemployment problem in the near future as the country fails to create enough jobs for higher educated individuals. On the other hand, the low-skill market becomes dominated-by/dependent-on low-skill refugees. This again creates conflicts in the society: firms become dependent on Syrians to keep labor cost down, natives are concerned by the competition on the job market. This story totally goes against "a healthy integration process". For these reasons, policies intended at educating refugees, give them work permits, place them into sectors with labor shortages based on a long-term job interventions programs, minimize fierce competition for low-pay/low-quality jobs become even more important.

**Table 19.2**

Syrians integration and economic activity

|  | *Dependent variable:* | | |
|---|---|---|---|
|  | **GDP Official statistics** | **GDP nightlight** | |
|  | **(2014)** | **(2018)** | **(2017)** |
|  | **(1)** | **(2)** | **(3)** |
| sync1 | 0.801*** | 2.855 | 4.942 |
|  | (0.208) | (8.493) | (8.358) |
| scale(prov_university) | – | 1.954*** | 2.199*** |
|  | – | (0.491) | (0.484) |
| scale(Syrians.at.public.schools) | 0.074*** | −0.883*** | −0.974*** |
|  | (0.015) | (0.271) | (0.267) |
| scale(Refugee.percentage) | −0.088*** | −0.346 | −0.313 |
|  | (0.010) | (0.208) | (0.204) |
| prov_x2y | 0.113*** | 0.004*** | 0.004*** |
|  | (0.014) | (0.001) | (0.001) |
| Constant | 9.057*** | 0.894 | 0.639 |
|  | (0.024) | (0.917) | (0.902) |
| Observations | 966 | 75 | 75 |
| $R^2$ | 0.325 | 0.914 | 0.927 |
| Adjusted $R^2$ | 0.323 | 0.908 | 0.922 |
| Residual Std. Error | (df = 961)0.290 | (df = 69) 1.593 | (df = 69) 1.568 |
| F Statistic | (df = 4; 961) 115.840*** | (df = 5; 69) 147.339*** | (df = 5; 69) 175.718*** |

*Note*: *p<0.1; **p<0.05; ***p<0.01

## 19.4.3.5 Does Integration and Education have an Impact on Economic Well-Being?

As a final analysis, we tried to understand the relation between refugees' education and integration with economic well-being.

We estimate a regression with the level of (per-capita) GDP in 2014 (last available official information) as dependent variable to assess the correlation between economic situation in Turkish provinces and the conditions of interactions between natives and refugees. We use as independent variables in the regression:

- Synchronization of calls: it is a variable, computed from Dataset 1, indicating the tendency of a region to have activities in sync with other regions. Formally, for each couple of regions $i$ and $j$ we compute the average daily Mutual Information (MI) between the calls outgoing or incoming in that regions. In [14], this variable has been considered as an indicator of social interaction and bridging social capital. Here we focus on the synchronization between calls made by natives and refugees as a signal of integration.

- Refugee percentage

- Sum of communications between Turkish and Syrians (variable $x2y$): indicates the interaction (in terms of telephone calls) of natives and refugees

- Number of Syrians at public schools

We find that our synchronization metric is positively related to GDP. Similarly, the value of communication interaction existing between natives and refugees ($x2y$) is positively related to economic activity (see Table 19.2). We find also a negative relationship with the percentage of refugees, which perhaps may indicate that areas where refugees have been located are actually those with lower economic activity, while on the contrary there is a positive effect of both the number of Syrians accessing public schools which might suggest that a policy of integration implemented via a shared public education could be a positive tool to improve the economic situation.

However, it is important to emphasize that a number of confounding variables can bias these results. For example, there are some economically advantaged areas (such as Izmir, Bursa, and parts of Istanbul) that never had TECs (or relatively few). In these areas, enrolment in Turkish Public Schools by Syrians was always relatively higher, while enrolment in TECs is dominant in the economically disadvantaged southeast.

Provided that national official statistics on economic activity report data only up to 2014, we run a robustness check on our results using data on night light (NOAA VIIRS/DNB dataset) in 2017 and 2018 as a proxy for economic activity [12]. Data, in this case, are processed at the province level. We use as independent variables the same as in the previous model by also including the percentage of University students at province level (variable $prov\_university$).

We find that the synchronization variable is no longer significant while the variable measuring the interaction in calls between natives and refugees is positive and significant, in line with previous results suggesting that integration supports economic activity. Also, the presence of university students is positively related to stronger economic activity while the opposite is true for the presence of Syrians at public schools. We interpret this change of sign as a potential indicator of the presence of shadow economy (see [15]) which is not

captured in the official statistics data while in turn is present in the collection of data made using night light: more Syrians in public schools identify probably areas where shadow economy run by immigrants is lower.

### 19.4.3.6 Discussion

Higher integration between natives and refugees seems positively related to stronger economic activity. This effect may be explained through the channels of higher levels of trust and the presence of norms of civic cooperation in areas where higher integration has been achieved and/or the coexistence between natives and refugees has improved.

Despite these encouraging results, we fully acknowledge that no causal claims can be made from this analysis and further work is needed to control for the many confounding variables present.

## 19.5 Conclusion

Investments in education will not only work toward increasing Syrians' school enrolment rate but will also impact their integration in the Turkish society. The analysis presented in the paper provides quantitative elements supporting policies to reduce conflicts over education resources, improve Syrians' education and integration, and contribute to the well-being of Turkish and Syrian society.

## Footnotes

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   http://www.hurriyetdailynews.com/63-percent-of-syrian-children-in-turkey-attend-school-education-minister-132276 (http://www.hurriyetdailynews.com/63-percent-of-syrian-children-in-turkey-attend-school-education-minister-132276).

2. 2.

   Many school buildings have been arranged for double-shift sessions in neighborhoods heavily populated by Syrians. Those schools provide education to Turkish students in the first shift and Syrians in the second shift starting at 14:30.

3. 3.

   https://explorer.earthengine.google.com/#search/tag:lights (https://explorer.earthengine.google.com/#search/tag:lights).

4. 4.

   https://data2.unhcr.org/en/situations/syria/location/113 (https://data2.unhcr.org/en/situations/syria/location/113).

5. 5.

   http://pictes.meb.gov.tr/www/saha-ziyaretleri-ankarada-devam-ediyor/icerik/44 (http://pictes.meb.gov.tr/www/saha-ziyaretleri-ankarada-devam-ediyor/icerik/44).

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