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CHARACTERISTICS OF SOCIAL CAPITAL CONDUCTIVE TO REFUGEE INTEGRATION:
AN ANALYSIS OF TÜRK TELEKOM CALL-DETAIL RECORDS

BRYNNE GODFREY
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Reviewed and approved* by the following:

Michael Gechter
Assistant Professor of Economics
Thesis Supervisor

Russell Chuderewicz
Professor of Economics
Honors Adviser

* Signatures are on file in the Schreyer Honors College.

ABSTRACT

This paper studies the relationship between social capital and socio-environmental variables in Turkey to aid refugee integration resulting from the Syrian Refugee Crisis. Call-detail record data is used, provided by Türk Telekom mobile operator, and serves as a proxy for economic and social integration. I employ a three-step methodology, consisting of identifying network integration indicators, simulating infrastructural and socioeconomic environments, and statistically assessing and correlating behavioral indicators with these environments. Results confirm that bridging social capital in Turkey is in fact positively correlated with infrastructural variables such as places of worship, schools, community centers, and social centers/facilities. Social capital appeared to be most strongly correlated to Muslim and Muslim-Sunni places of worship, representing locales where both refugees and Turkish natives share common values and beliefs.

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Chapter 1

Background

Introduction

The Syrian Refugee Crisis is flagged by UNHCR (2019) as one of the worst humanitarian crises of our time. Thousands of Syrians flee from the volatile conditions each day, turning mainly to neighboring countries Jordan, Lebanon, and Turkey for refuge. Turkey hosts the largest number of Syrian refugees, increasing by around 1,000 per day (Kirişci et al. 2018).

As Syrians flood into Turkey, the Turkish government is left to confront the challenge of helping these refugees to successfully integrate into their new community. An important aspect of integration is the concept of social capital, defined by OECD as, “networks together with shared norms, values and understandings that facilitate co-operation within or among groups” (Brian 2007, p. 102). Even more, social capital includes, “institutions, relationships, attitudes and values that govern interactions among people and contribute to economic and social development” (Grootaert & Van Bastelaer 2001, p. 4). Bridging social capital, or the connections made across groups with different races, classes, religion, or other qualitative differences, is of heightened importance as it allows for those new into a community to make connections and thus allows for easier integration (Claridge 2018).

The problem arises from the fact that the Turkish population that facilitates these networks or interpersonal relationships, thus raising the social capital and ease of integration into

a community, are scarce. The majority of Turks blame Syrian refugees for economic hardships, cultural differences, and competition for employment, among other things. Moreover, NBC News interviewed Turks that claim members of their country express “anti-Syrian” sentiments, worried that Turkey is going to become “a Middle Eastern Country” (Jovanavski 2019). In Turkey, the number of Turks over the year of 2017 that could be considered as contributing to the social capital in a community through calling records were less than one percent. This indicates that there is a lack of help from the Turkish communities refugees are living in, and thus a lack of successful integration. While calling patterns are not reflective of all networking efforts, these findings suggest that phone-based connections are minimal. Face-to-face communication is another important alternative, although anecdotal evidence supporting those networks is lacking. Pinpointing the prevalent characteristics of the few Turks that are contributing to the social capital in Turkey could provide insight to governments or policymakers on strategies and features that could be useful to aid refugee integration.

This paper aims to characterize the native population in Turkey that is contributing to the bridging social capital in the country, in order to pinpoint what characteristics of Turks are most conducive to refugee integration. Call-detail record (CDR) data allows for the identification of social networks between refugees and Turks, and thus can be used as a proxy for economic and social integration. The ability to geo-locate CDR data also allows for insight into the environments heightened social capital exists in, and the supporting infrastructure and geographic variables that aid refugee integration. Connecting demographic and socio-environmental data to the regions with a prevalence of social capital also allows for insight into community profiles that promote integration.

The Syrian Refugee Crisis

Conflict in Syria has rapidly turned into a major humanitarian crisis that continues to intensify. Over 5.6 million have fled the volatile conditions in Syria since the beginning of the Syrian Civil War in 2011 (UNHCR, 2019). The war began when pro-democracy demonstrations spread throughout the country in an effort to bring an end to President Bashar al-Assad's authoritarian regime. The Syrian government suppressed these demonstrations through the use of violence, using police, military, and paramilitary forces (Encyclopaedia Britannica, 2018). Not long after, civilians formed the Free Syrian Army, and the conflict has since expanded into a full civil war. The conflict drastically worsened when Syria's allies Iran and Russia became involved in support of Assad.

Hundreds of thousands of innocent civilians have been caught in the cross-fire and killed. Infrastructure has been destroyed, and food and medical supplies are sparse. Human rights violations are frequent and widespread. The U.N. estimates that 6.2 million are internally displaced in Syria as a result of the crisis. This number continues to increase as an estimated 6,550 people are displaced every day (Mercy Corps, 2017).

Many civilians began to flee to bordering countries Jordan, Lebanon, and Turkey to escape the volatile conditions in Syria. The refugee camps intended to house Syrian refugees only accommodate around eight percent of those that have fled Syria; instead, the majority of refugees live in urban areas, contributing to urban congestion and overcrowding of these host cities (UNHCR, 2019).

Syrian Refugees in Turkey

According to Kirişci et al. (2018), Turkey hosts the largest number of Syrian refugees, currently standing at over 3.5 million; these numbers increase by around 1,000 people each day. Over 95% of Syrians in Turkey reside in urban areas, with some cities hosting more refugees than Turks (Kirişci et al., 2018). As the number of refugees in Turkey increases, it becomes increasingly challenging to cater to the needs of refugees and ensure their well-being. A major challenge to refugee integration in Turkey is the attitudes of the Turkish population towards refugees. Polls conducted in Turkey reveal that the majority of Turks resent Syrian refugees, viewing them as a burden and blaming them for the deterioration of public facilities, rising unemployment, and price increases (Kirişci et al., 2018).

A Syrian refugee living in Turkey interviewed by NBC news stated that he avoids revealing his nationality in fear of retaliation; Mahmoud Maktabi says, “When they hear that I’m Syrian, they will treat me bad. They show their anger, I don’t know why” (Jovanavski 2019). The Turkish population becomes increasingly hostile towards Syrian refugees as cultural changes occur throughout the country. Refugees opening businesses and selling specialty Syrian goods write their storefront signs in Arabic instead of the Latin norm in Turkey, signaling that they are Syrian and resulting in growing discomfort among Turks (Jovanavski 2019).

There also remains the problem of a shortage of financial resources to support refugees. Local governments by law are commanded to serve only Turkish citizens. Therefore, governments do not receive excess funding in order to support the refugees that move into their municipalities. Leaders of local governments also fear that if they provide increasing resources to refugees, it will increase the flow of refugees into their municipalities. This fear has proven to be true for certain districts in Istanbul (Kirişci et al., 2018).

The challenge of access to education and employment for refugees also remains a consistent problem. According to Kirişci et al. (2018), a third of Syrian refugees are not in school. The majority of Syrian refugees also lack access to the labor market, and an estimated 1.5 million Syrians work informally despite legislation towards work permits for refugees. Businesses in the Turkish economy have since begun to rely heavily on informal employment, and about one-third of the economy is based on informal employment (Kirişci et al., 2018). This has led to an increased competition for jobs among Turks and refugees (Jovanovski 2019).

Despite these challenges and a mostly hostile population, the Turkish government continues to attempt to address the refugee crisis and help refugees integrate into Turkey successfully. Municipalities have hosted free language courses and established social support programs to help assist refugees in opening businesses and participating in citizen councils. A migration policy center as well as civil society organizations have also been founded in order to support refugees (Kirişci et al., 2018). Still, the Turkish government lacks guidance when it comes to implementing a long-term integration strategy for refugees, and has viewed their presence as temporary because of this. Identifying and validating community and native characteristics that have been correlated with refugee integration could aid policy makers in adapting a long-term strategy to help refugees integrate. In turn, this could help the Turkish government to more efficiently allocate their resources as well as help alleviate urban congestion and poverty.

Religion in Turkey

Religion is very important to the Turkish population, and one's religious beliefs can drastically affect other aspects of their daily life. The Islamist AKP party, ruled by President Erdogan, has highly promoted the connection between Muslims and Turks (Karaçizmeli 2015). According to the Bureau of Democracy, Human Rights, and Labor (2017), "99 percent of the population is Muslim, approximately 77.5 percent of which is Hanafi Sunni" (p.2). Likewise, Sunnis account for 74 percent of the Syrian population (Bureau of Democracy, Human Rights, and Labor 2011). Other religious groups in Turkey represent an estimated .3 percent of the population while around two percent of the population reports themselves as atheist (Bureau of Democracy, Human Rights, and Labor 2017).

The Armenian Weekly highlights the importance of religion in Turkey, stating, "all religious groups that are not Sunni Muslim suffer from discrimination and persecution in Turkey" (Sassounian 2018). Religious minorities are often forced to take mandatory Islamic classes in school and experience difficulty opening or operating places of worship as well as settling land and property disputes. (Sassounian 2018).

Those of Christian or Jewish religion, defined as "non-Muslim minorities" are often granted a special status, but atheists and non-Sunni Muslims often face backlash and discrimination. Alevis are the largest group of non-Sunni Muslim, and their places of worship are not recognized by the government (Sassounian 2018).

Chapter 2

Social Capital

The Importance of Social Capital in Community Structures

The concept of social capital is comprised of two key components: the structural component including social networks, and the cognitive and attitudinal component comprised of shared norms, trust, and reciprocity (Kindler et al., 2015). Pertaining to social capital in migrant integration, Coleman (1990: 305) defines social capital as forming resources that can be used by actors to identify their interests. Coleman further classifies social capital as, “anything that facilitates individual or collective action, generated by networks of relationships, reciprocity, trust and social norms” (Coleman, 1998, 2000).

Coleman (1990: 306) goes on to divide social capital into two groups: consumerist motivation, comprised of internalized norms and solidarity, as well as instrumental motivation, made up of reciprocity exchange and enforceable trust. Reciprocity and the level of trust are highly interconnected in a community. Overall, the two main functions of social capital are to act as a source of control (Coleman 1990) as well as a source of resources that facilitates access to jobs, markets, and loans (Bourdieu 1986). An important aspect of social capital is that the collaboration that social capital facilitates should benefit both parties (Aguilera 2016).

The usefulness of social capital is highly dependent on the quality and variety of social ties and networks, hence the quality of the resources present in each. Dahinden (2013) identifies resources present in social networks as the variety and quality of contacts. Social capital increases in quality when the contacts in a social network are more differentiated. A stronger

network is classified as one comprised of both ‘strong and weak ties’ and connections that are qualitatively different, such as connections of different ages, genders, ethnicities, or classes. Connections can also differ in the role they play in one’s life, such as a friend, boss, or co-worker (Granovetter 1973).

The Role of Bridging Capital in Integration

Putnam (2007) developed two subsets of social capital referred to as bonding social capital and bridging social capital. Bonding capital refers to the connections made within communities, groups, or organizations while bridging capital refers to connections made across them. Bridging social capital will often connect individuals with different qualitative backgrounds, such as race, class, or religion (Claridge 2018). Bonding and bridging capital are not mutually exclusive; an individual can have many bonding ties and bridging ties simultaneously.

Historically, bridging capital has been thought to play an essential role to integration. Claridge (2018) describes bridging as “associations between people with shared interests or goals but contrasting social identity.” Bridging capital is essential to migrants or individuals new in a community, especially those coming from backgrounds differentiated from the rest of the community. This is due to the fact that bridging, “tends to increase the tolerance and acceptances of different people, values, and beliefs through contact with diverse others” (Claridge 2018).

Bridging social capital can also help integration because it allows the sharing and exchange of information and ideas across different groups while also building a consensus among these groups (Claridge 2018). Migrants often bring their own distinct backgrounds and

ideas to a new community, and are usually uninformed of the existing interests or goals of the new community. By interacting with the Turkish population of that new community, Turks are able to teach and influence migrants of existing ideologies and resources in the community, and migrants are able to find their fit in the community depending on their skills and interests.

Through the influence of the Turkish population due to bridging social capital, ideologies and interests of migrants could also change. Paxton (2002) states that individuals could experience changes in existing values, preferences, and the capacity to act through participation in organizations. This is due in part to the fact that relationships through communities and groups increase the flow of ideas and opinions, while also serving as a heightened barrier to extremist views as they are more easily challenged (Paxton 2002). The transformation of different ideologies and interests into shared views could also ease the sense of belonging and integration of migrants into a new community.

The Importance of Weak Ties

One may assume that stronger ties between individuals prove invaluable when compared to weaker ties. However, weak ties can be just as useful to an individual as strong ties, if not more so. This is reflected in the difference between close friends exhibiting strong ties and acquaintances with weak ties. Granovetter (1977) notes that empirical evidence has demonstrated that individuals with a stronger tie are more similar than individuals with weaker ties. In theory, weaker ties could be of more value because acquaintances are more likely to introduce individuals to new people, as opposed to friends that will likely have overlap in their social networks. Weak ties are also much more likely to act as bridges than strong ties due to

this, as individuals with weak ties are less likely to know each other's social networks. Wegener (1991) points out that weak ties have increased importance for low-status individuals, as they are able to choose from strong-tie connections from a wide range of other statuses to access social resources; those with a higher status must rely on weak ties to contact others outside of their network with a higher status.

The Role of Social Capital on Economic Performance

Sustainable economic development has traditionally included human, natural, and physical capital. In recent years, this definition has expanded to include social capital, as the way in which, "economic actors interact and organize themselves to generate growth and development," is regarded as an essential aspect to development that was previously overlooked (Grootaert & Van Bastelaer 2001, p. 7).

While social capital cannot produce economic growth on its own, it can serve as a compliment or substitute to other forms of capital. The close relationships one may have with family or friends can act as a substitute for lack of access to financial capital, as those coming from lower income households may not have the collateral necessary to receive a loan. Social capital in the form of relationships could help to bridge this gap and provide easier access to funds (Aguilera 2016).

Social capital can also serve as a substitute for human capital. If there is a problem pertaining to a lack of knowledge, advice from a friend or alternative source in the community can help to solve that problem. Social capital can also help one to get a job, as a friendship or relationship can serve as a substitute for one's skill set (Aguilera 2016).

Paul Collier of the Social Capital Initiative (SCI) believes that social capital is economically beneficial because social interactions will always result in at least one of three externalities. These include reducing opportunism, as social capital facilitates the sharing of the behavior of others; reducing market failures in information, as social capital facilitates sharing knowledge regarding technology and markets; and reducing free riding, thus initiating collective action. Collier also differentiates two subsets of social capital as formal and informal; formal social capital includes organized clubs, institutions, or organizations, while informal social capital includes networks such as interactions (Grootaert & Van Bastelaer 2001, p. 6).

The role of institutional capital is also of great importance in facilitating social capital. The World Bank's *World Development Report 2000/2001* states, "External support- from NGOs and religious organizations, for example- can help create social capital that increases the voice and economic opportunities of poor people" (Gillis et al. 2001).

In this way, formal and informal social capital are highly interconnected. Without formal institution-based social capital, informal social capital would be scarce; this is due to the fact that institutions that act as formal social capital bring actors together and allow for interaction.

Using Cell Phone Data to Estimate Social Capital

Social capital can be harder to measure than other forms of capital as social capital is intangible. Historically, surveys have been a common method used to measure social capital. In recent years, technological advancements have made cell phone data a viable and increasingly popular strategy to gain insight into the level of social connectivity in populations. Call-detail records (CDRs) give researchers a concrete numerical figure pertaining to the frequency of calls

from a specific caller to callee. The percentage of calls between refugees and Turks can serve as a proxy for economic and social integration on an individual level, in order to identify Turks that are interacting more with the refugee population and thus draw conclusions about the community members contributing to integration.

Chapter 3

Empirical Analysis

Summary of Relevant Empirical Work

Social capital is highly beneficial to economic performance, as it can help to facilitate economic growth and thus aid in the development and well-being of a country. The effects of social capital on economic performance have been examined through unconventional methods, as social capital has historically been harder to measure than traditional capital. Neira et al. (2008) used panel data in order to measure the impact of social capital on economic growth. The degree of social confidence was measured through the use of social trust as a proxy for social capital. A membership variable was also used in order to measure the community cohesion resulting from membership in a group or organization. Other independent variables include investment per capita and human capital while the dependent variable was GDP per capita. Findings of this study include a positive relationship between social capital and economic growth, as well as an interaction between social and human capital, both exhibiting a positive effect on development.

Knack and Keefer (1997) aimed to portray a national representation of trust between citizens as well as between citizens and their respective governments by using data from the World Values Surveys. Cross-sectional data was used for 29 countries. Economic growth was controlled with human capital, through the use of the percent of primary and secondary school

attainment in the total population. Civic trust and members of a group served as proxies for social capital, with GDP as the dependent variable. A positive and significant relationship was found between trust and economic growth, while group members had a non-significant effect. Overall findings indicated that trust was positively correlated with better government corruption ratings and efficiency, as well as a higher infrastructure quality.

Literature pertaining to the differences between strong versus weak ties has commonly found that weak ties have been more valuable to individuals when compared to strong ties. Both Langlois (1977) and Erickson and Yancy (1977) have found that weak ties have more frequently resulted in new jobs, although this varied across occupation. This seemed to be more prevalent for higher-skilled, managerial roles than low-skilled occupations. However, Lin et al. (1981) found that the positive effects of weak ties on occupational status only applies when the weak tie connects an individual to an individual of high-status.

A number of past literatures have attempted to examine social integration theory. Zhou and Bankston (1994) investigate the contribution of social capital to the adaptation of the younger immigrant population. Vietnamese youth living in an immigrant community in eastern New Orleans are examined for insight into the aspects of immigrant culture that act as a form of social capital and affect the adaptation of immigrant offspring. This study finds that immigrant students tend to reach higher academic achievement when they exhibit values and behavioral patterns that are consistent with the expectations held in their community, and thus reflect a higher level of social integration. These findings lead to the conclusion that strong positive immigrant cultural orientations can serve as social capital and promote constructive forms of behavior as well as value conformity.

The European Council on Refugees and Exiles (ECRE) views refugee integration as a reciprocal process, placing demands on both the individuals integrating as well as the host communities (ECRE 1999: 29). Integration requires a refugee to adapt one's lifestyle while requiring a host community to adapt new institutions to accommodate the refugees. Integration is argued to be multi-dimensional, as relevant ideologies involve conditions to participate in society, actual participation in society, and the way that acceptance is perceived in the host community.

Losi and Strang (2008) find that attempts for a host community to help refugees integrate are often compromised if the refugee does not intend to stay in the host community and views the destination as temporary. However, once refugees decide that they want to stay in the host community, they have a stronger motivation to contribute to the host society and avoid dependence. Smyth and Kum (2010) identify a contribution as a commitment to regaining a sense of identity and self-esteem. Hence, bringing a contribution to a host community allows refugees to feel as if they identify with that population, and brings a sense of belonging.

A study conducted by Kearns and Whitley (2015) examines the relationship between 'functional factors' such as education, language, and employment and the host capacity of refugee communities. They find that functional factors influenced neighborly behavior, social relations, and the sense of belonging among refugees. Time was also positively associated with social integration indicators. An alternative study on the host community was conducted by the Crisis Group (2018) on Syrian refugees in Istanbul's Sultangazi neighborhood. The role of existing political conflict was found to create a high variance of native perceptions of refugees. The study concluded that ethnic, religious, and political heterogeneity between Turkish population and refugees could deter integration.

IOM (2017) studied three regions in Turkey to examine social cohesion, defined as the shared norms that facilitate cooperation within or among groups. Three recommendations arose from the results of this study, the first being a need for mutual language acquisition; a common concern among focus groups and surveys was the inability to communicate across the Turkish/Arabic divide. Another recommendation was to provide support for accurate information dissemination in order to overcome misplaced blame and misperceptions among host communities. The last recommendation was to provide social events and joint assistance in order to allow for better integration.

Another area of interest among social integration is secondary migration patterns, or movement patterns within the host country. Bloem and Loveridge (2017) found that these patterns can inform key decisions regarding relocation, which is especially important due to the fact that the majority of Syrian refugees do not live in camps. Bagir (2017) defined secondary migration as the movement from areas near the Turkish border to areas near the inner regions in Turkey. This study finds that primary migration patterns are linked to negative employment and wage effects on low-skilled refugees with less experience. Secondary migration is found to have no effect on employment while negative wage effects are exhibited again for low-skilled, less-experienced refugees.

The dataset utilized in this study was only recently released in 2018. Therefore, studies with the same dataset are still currently being conducted. The first and only known study at this time was published at the beginning of 2019. Kiliç et al. (2019) investigated mobility patterns of refugees from multiple points of view. Refugee movement per district was investigated monthly to determine what districts were increasingly attracting refugees and which districts were attracting refugees during specific months. Results indicated that refugees are highly mobile in

Turkey as a survival mechanism. Fatih, Istanbul was identified as a popular hub for refugees, and the city of Istanbul was found to host the largest number of Syrian refugees. It was also found that a higher concentration of calls occurred on the European side of Istanbul. Data analysis on Fatih and two other distinct districts and cities with a high proportion of refugees also indicated that refugees living in low-status neighborhoods tended to be more introverted than refugees in middle and high-status neighborhoods. Refugees tended to prefer low-income areas in closer proximity to fellow refugees in Fatih, Istanbul; the authors speculate that this was due to affordability as well as close proximity to public transport lines.

Data Description

The dataset used in this study was provided by Türk Telekom, via the Data for Refugees (D4R) Challenge. Dataset 2: Fine Grained Mobility is the dataset employed for the purposes of this study. This dataset consists of anonymized Call Detail Records (CDRs) of over 61 million calls between nearly 3 million users. Data were collected from January 2017- December 2017.

Dataset 2 contains cell tower identifiers used by a randomly chosen group of active users to make phone calls and send texts. Each record in this dataset represents a unique call from a caller over the study period, and is organized based on the following fields: caller ID, timestamp, callee prefix, site ID, and call type. Phone numbers for each user are removed, and replaced with a unique random number that acts as an identifier instead; the number will start with 1 if that caller is a refugee, 2 if that caller is a non-refugee (Turkish caller), and 3 for unknown. The callee prefix reflects this same pattern, although identifiers are not unique and can only be identified as either 1, 2, or 3.

Figure 1 below displays the geographic distribution of the base stations (black markings) that serve as the geospatial level of analysis from which call patterns can be detected in Turkey. Each station will be joined with numerical integration indicators as well as socio-environmental variables for the purpose of this analysis.



Figure 1: Geographic Distribution of Cell Base Stations

The use of geographic variables is an essential aspect of this study to measure social capital. Grootaert & Van Bastelaer (2001) state, “Using membership in local associations as an indicator of structural social capital consists of counting the associations and their members and measuring various aspects of membership” (p. 23). While association membership is one aspect of social capital, this study will make very general assertions based on presence rather than membership in association. Geographic socio-environmental variables will be utilized in the form of points of interest (POIs) as well as the distance to variables pertinent to the Syrian refugee crisis in Turkey. POI variables include institutions such as community centers, places of

worship, schools, and social centers/facilities. Variables pertaining to the Syrian refugee crisis include the distance to Syrian refugee camps in Turkey as well as the distance to Syrian border crossing sites. POI spatial data and Syrian border crossing sites came from the Humanitarian OSM Team and Turkey refugee camp site spatial data came from UNHCR and the Regional IM Working Group in Europe¹.

The distinction of refugees versus Turkish population in the dataset is an essential aspect for the purposes of this study. Overall, 2,782,683 randomly selected unique callers were observed; these callers placed 61,277,260 calls. A summary of these calls by the caller and callee statuses is displayed below.

Table 1 below exhibits the total calls made by refugees and Turks by callee status. This table shows that the majority of calls went to Turks while the minority went to refugees. Calls to unknown callees also account for a large majority of the calls in this dataset, although the majority of the callees are Turks. Despite the fact that there are far more Turks than refugees in the Turkish population, a chi-squared test for independence on this dataset results in a statistically significant result; therefore, strong evidence exists to suggest that refugees and non-refugees tend to have different preferences for the status of callee they place calls to.

Table 1: Total Calls by Caller and Callee Status

| | Refugee Caller | Turk Caller |
|----------------|----------------|-------------|
| Refugee Callee | 205,547 | 22,256 |
| Turk Callee | 2,716,038 | 30,556,542 |
| Unknown Callee | 2,875,718 | 24,901,159 |

¹ All spatial data hosted by <https://data.humdata.org/>

Tables 4-5 in the appendix display summary statistics for refugee and Turk call patterns on an individual level. On average, refugees made around 12 calls while Turks made about 24. The majority of refugee calls went to Turks while Turks placed most of their calls to other Turks; this would suggest that there is a larger amount of bridging social capital within the refugee population and a larger amount of bonding social capital within the Turkish population. However, this pattern could also simply reflect the fact that most of the population is Turkish.

Descriptive Statistics of Turkish population Contributing to Social Capital

As the majority of Turks make calls solely to other Turks, it is important to identify the few in the Turkish population that are contributing to the bridging social capital in Turkey. Table 4 below represents the proportion of these Turks compared to the total number of Turks in the sample. Turks were identified as “active” callers, or callers contributing to social capital in Turkey, when they placed 10 or more calls to refugees throughout individual two-week study periods. The definition of “active” callers is based off of Khan’s (2015) study. Compared to over two million Turks that were a part of this study, only 287, or less than one percent of total Turks actively communicated with refugees. These summary statistics exhibit the rarity of Turks contributing to social capital in the Turkish population.

Table 2: Turkish population Contributing to Social Capital

| Total Turkish population | Turkish population Contributing to Social Capital | Percent Turkish population Contributing to Social Capital |
|--------------------------|---|---|
| 2,288,770 | 287 | 0.000125 |

Tables 6-8 in the appendix show further summary statistics for active Turk callers. From table 5, these Turks still made the majority of their calls to other Turks, as only about 21 percent of total calls in this sample population went to refugees. However, this population makes a far larger percent of their calls to refugees, as only .00972 percent of calls in the total Turkish population went to refugees. Despite the results of the chi-square test, this could still be due to the fact that there are far more Turks in the sample than refugees. The average individual caller in this group made around 22 calls, or 30 percent of their total calls, to refugees.

Possible Measurement Issues

The data being utilized for analysis presents various possible measurement issues. Possibly the most prevalent is that a group of users is only observed for a two-week period in order to protect privacy. A fresh sample of active users is drawn at random at the end of each two-week period. New random identifiers are chosen in each time period as well. Another problem presented is that the indicators for each caller and callee representing refugee or Turk status are considered to be somewhat noisy. The Turkish population could be included among the users marked as refugees, and vice versa; it will not be possible to declare the status of a user with 100% certainty. In addition, this dataset only covers CDR data from the mobile operator Türk Telekom. However, there are multiple mobile operators in the region. Therefore, while the number of phone calls and conversations serve as indicators for the total number of conversations in the area, they do not represent total actual numbers. One last measurement issue is that the exact physical location of each call is not provided in order to protect privacy. The ID of the cell tower that handled the call is the only information recorded in the dataset. It is

important to note that depending on how busy a tower is and the physical layout of the land, calls may not always be handled by the closest cell tower.

Geographic Dispersion of Turkish population Contributing to Social Capital

Figure 2 below geographically shows the count density of active Turks per city. Home districts and cities for Turks were identified as the districts/cities where individual active Turks placed the majority of their calls. From the map, the majority of these Turks reside in Istanbul. Istanbul is one of the main Turkish cities refugees reside in; as of 2018, at least 560,000 registered Syrian refugees lived within the city (Kirişci et al. 2018).



Figure 2: Geographic Distribution of Turkish population Contributing to Social Capital by City²

² D4R data for refugees: <http://d4r.turktelekom.com.tr/>

Table 3 below shows the top 10 districts with the highest count density of active Turks. Although the city of Istanbul hosts the highest number of active Turks overall, the district with the highest number of active Turks is instead in the city of Gaziantep. However, half of the districts listed in Table 3 are in the city of Istanbul.

Table 3: Geographic Distribution of Turkish population Contributing to Social Capital by District (Highest-Lowest)

| District (City) | Number of Active Turks |
|----------------------------|------------------------|
| 1. Şahinbey (Gaziantep) | 47 |
| 2. Fatih (Istanbul) | 27 |
| 3. Beykoz (Istanbul) | 17 |
| 4. Yildirim (Bursa) | 14 |
| 5. Akdeniz (Icel/Mersin) | 14 |
| 6. Şişli (Istanbul) | 8 |
| 7. Şehitkamil (Gaziantep) | 7 |
| 8. Şehir Merkezi (Kütahya) | 7 |
| 9. Bayrampaşa (Istanbul) | 7 |
| 10. Ümraniye (Istanbul) | 6 |

Methodology

A three-step process was implemented in order to analyze the characteristics of the social capital in Turkey most conducive to integration. First, a set of mathematical network indicators was developed in order to quantify evidence of immigration integration, and Turks contributing the most to integration. Second, these indicators were spatialized and embedded into the GIS environment and layered upon socio-environmental data. Third, integration indicators were statistically correlated with the surrounding landscape. All data analysis and mining was completed using R and spatial analysis was completed using ArcGIS.

1. Integration Indicators from CDR data on Human Behavior:

Call-detail record (CDR) data is used to represent refugee and Turk behavior. The CDR data was divided into refugee and Turk subscribers when the subscribers first registered for their SIM cards. From this dataset, a metric of integration was created by designating high numerical thresholds of call frequency. Turks were flagged as “active” callers when they placed 10 or more calls to refugees (Khan 2015). As noted in the data description, this threshold accounts for less than one percent of the total Turkish sample in the study.

Sensitivity analysis was conducted in order to determine how many cell base tower locations to include in each caller’s activity space. Each Turk’s call locations were ranked by frequency of calls; this was done individually for each Turk identified as having a higher threshold of call frequency with refugees. The cumulative distribution function (Figure 3) below shows the percent of ranked locations that is at or below a given rank; this CDF pertains to the average ranks for all Turks in the group of interest. From the CDF, a rank of around 100 locations per caller is shown to account for about 100% of the locations callers visited, while a rank of 40 accounts for around 80% of callers’ visited locations. This study utilized callers’ locations up to a rank of 40.

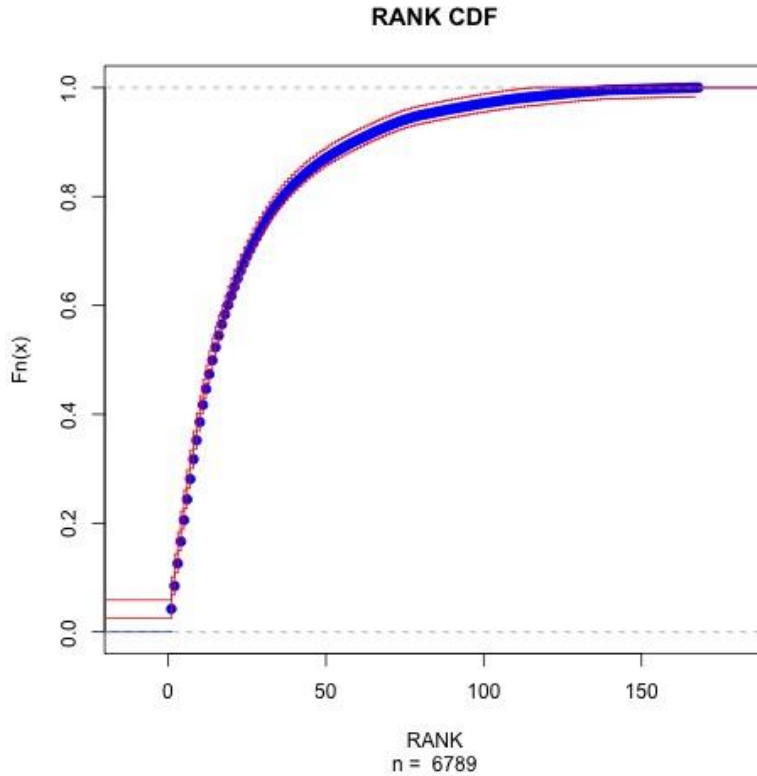


Figure 3: Cumulative Distribution Function

Note that 40 is the maximum cutoff for the number of cell base tower locations in a caller's activity space; some Turk's activity spaces were comprised of as little as one cell base tower location. The two CDFs below visualize the distinction between callers with few versus many call locations. Figure 4 below shows the percent of call ranks that is at or below a given call rank for a caller with a low number of call locations (10) while Figure 5 shows the percent of call ranks that is at or below a given call rank for the caller with the highest number of call locations (168).

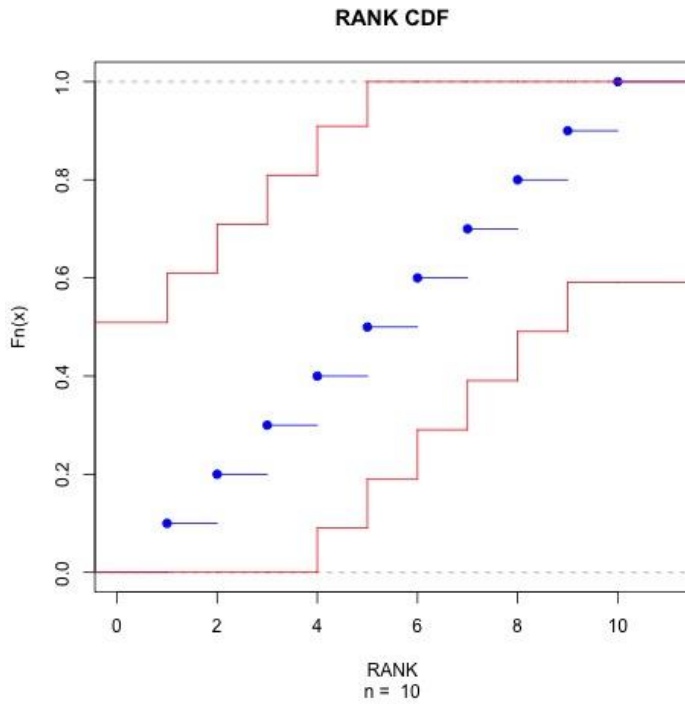


Figure 4: Cumulative Distribution Function- Low Number of Locations

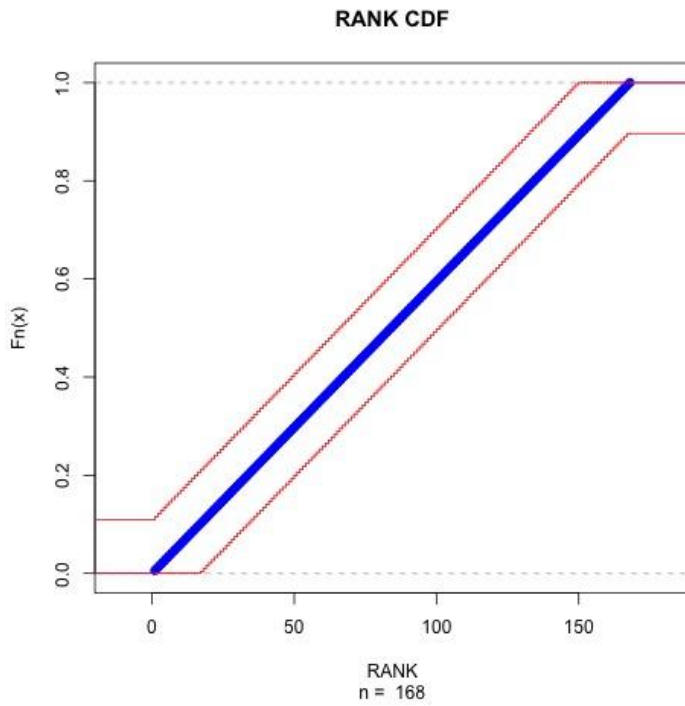


Figure 5: Cumulative Distribution Function- High Number of Locations

Each caller's top 40 locations were then mapped with a buffer dissolving all locations per caller in order to create individual activity spaces, or the local area an individual moves throughout the course of their daily activities. The size of the buffer was 1.6 kilometers around each base station location, as outlined in Dill (2004). Five random samples of 287 Turks were taken from the entire sample of Turkish callers in order to act as comparison groups to the Turkish group with a high threshold of calls to refugees. The amount of unique caller IDs generated from all five random samples amounted to 1432 Turkish callers; In other words, sampling with replacement was not specified, but the samples only repeated three callers throughout the study. The same methodology was performed for the sample groups as the group of interest.

2. Simulating Infrastructural and Socioeconomic Environments:

Socio-environmental variables were utilized in order to describe locales in which these Turks with higher numerical thresholds of calls to refugees reside. Each Turk's buffer was layered with spatial data on socio-environmental variables. The socio-environmental variables utilized to describe the surrounding characteristics of social capital formation were categorical points of interest (POIs) as well as distance to refugee camps in Turkey and Syrian border crossing sites. In order to test for social capital, the POIs chosen for this study were places thought to facilitate social interactions among groups; as discussed in the data description, community centers, places of worship, schools, and social centers/facilities were the variables of interest.

In response to the findings from the initial analysis outlined above, additional analysis was conducted on the places of worship variable. This variable was split into separate geographical variables based on the religion class at the place of worship. It is important to note that not all religion classes were pulled from the dataset for further analysis. It is also important to note that while the dataset came from the same source as the original POI place of worship data, it came from a different dataset that included religion; therefore, the original dataset could contain more spatial worship data as a place of worship may not be recorded in the religion dataset if religion information was not available for that location. Religion classes that became independent geographic variables include Christian, Christian-Catholic, Christian-Orthodox, Muslim, and Muslim-Sunni.

3. Correlating Behavior with Environment:

The socio-environmental variables were mapped in a GIS environment and layered on the activity spaces of callers created from the CDR data. Spatial joins were used to fuse variables that co-locate, or take up the same geographical areas. Performing spatial joins recorded the number of each point of interest variable that intersects a caller's activity space. Figure 6 below visually depicts this process. Pertaining to the Turkey refugee camp sites and the Syria border crossing sites, the distances were calculated and recorded from each caller's activity space to the nearest Turkey refugee camp site as well as Syrian border crossing site. Distance was calculated from the closest boundary of each caller's buffer to the closest point of interest variable. All calculations were performed for both the comparison group and the group of interest.

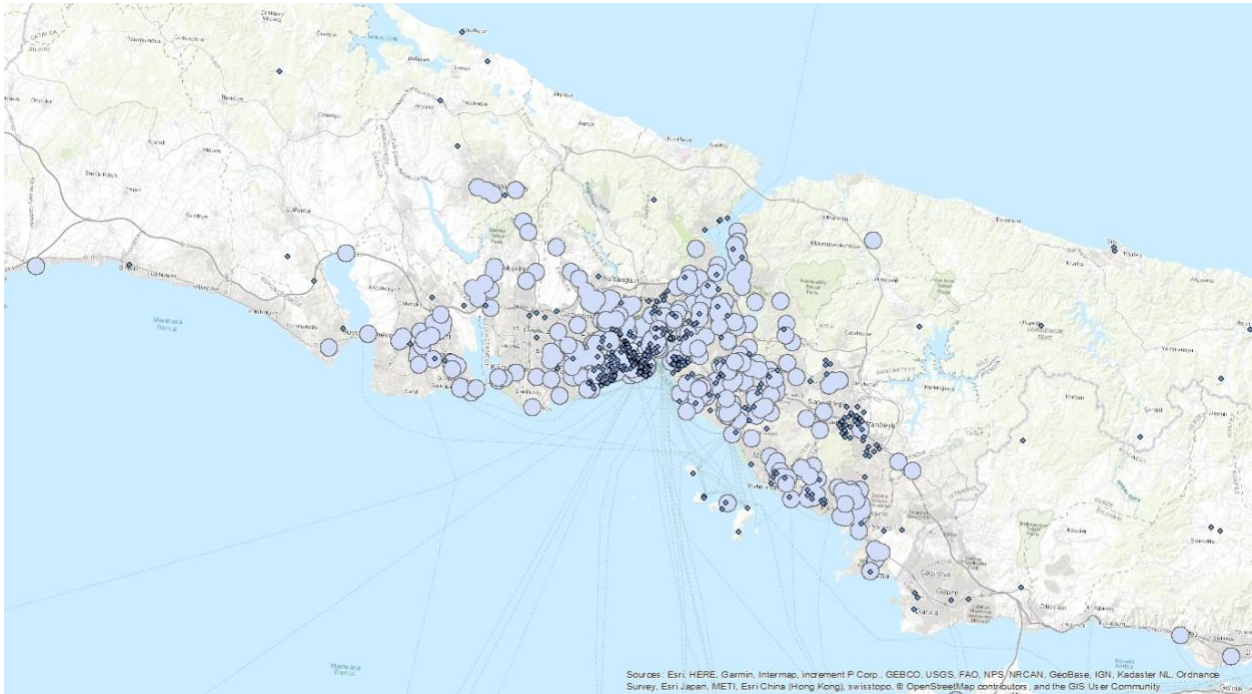


Figure 6: Activity Spaces Layered with Geographic Variables (Istanbul, Turkey)

Significance tests were used in order to assess the strength of the relationship between integration variables and socio-environmental variables. Specifically, two-sample t-tests were used in order to assess whether there was a true difference in means between the number of socio-environmental variables in callers' activity spaces for the comparison group and group of active Turkish callers. The null hypothesis is that there is no difference in means between the number of variables in each caller's activity space for both groups; the alternative hypothesis is that there is a difference in means between the number of variables in each group.

The equations are as follows:

$$H_0: \mu_{Active\ Turks} = \mu_{Sample\ Group}$$

$$H_A: \mu_{Active\ Turks} \neq \mu_{Sample\ Group}$$

Separate tests were performed for each socio-environmental variable, and the group of active Turkish callers was compared to five different sample groups in order to ensure validity of the results. Statistical correlations between integration metrics and socio-environmental variables were then assessed in order to determine which spatial elements in the environment are most significantly associated with integration. The level of significance for all tests was $\alpha = .05$.

Results

The results of the empirical analysis are displayed in Tables 9-14 in the Appendix. Out of the five significance tests for a difference in means between the comparison groups and group of interest, independent variables places of worship, schools, community centers, and social centers/facilities were found to have a statistically significant difference in means for each of the five tests. In other words, when compared to five different random sample groups, a statistically significant difference was consistently found between active Turks and each sample group. The independent variables distance to border crossing sites (meters) and distance to refugee camps (meters) did not yield statistically significant results for any of the five trials.

All four variables that scored statistically significant for all five trials were found to have a larger number of these socio-environmental variables in each caller's daily activity space for the group of active Turks when compared to the sample groups. Active Turks had an average of 40 places of worship in each caller's activity space while the sample groups had an average ranging from 12-19 places of worship in each caller's activity space. Active Turks had an average of 37 schools in their activity spaces while the sample group averages ranged from 14-23 schools. Community centers per activity space averaged six for active Turks while sample

groups averaged around three to five community centers per activity space. Social centers/facilities averaged around 10 per activity space for active Turks while averaging around three to five for the sample groups. The p-values for the majority of trials for variables found significant largely surpassed the $\alpha = .05$ level. From these results, it is interesting to note that sample groups had around half of the specified POIs in their activity spaces as active Turks did; this pertains to all POI variables except community centers, which the active Turk group yielded the most similar results for.

The high count per activity space along with the drastic difference in means pertaining to the places of worship variable prompted further analysis as to what types of worship along with what predominant religions were most frequent in the group of interest's activity space. Tables 15-19 display these results. The religion class with the highest number of places of worship was Muslim, averaging around 14 for the group of active Turks and 5-7 for the sample group. Muslim-Sunni was the second highest religion class, ranging from 11 for the group of active Turks and 3-5 for the sample group. These two religion classes along with the Christian religion class scored statistically significant for a difference in means between the two groups; the difference in means for the Christian religion class was around 4 for the group of active Turks and about 1 for the sample group. Both Christian-Catholic and Christian-Orthodox religion classes had nearly the same count per activity space between groups; the average count for each group was less than one for all trials.

Chapter 4

Conclusion

Empirical Analysis Conclusions

The findings in this paper support the notion that social capital in Turkey is correlated with specific institutions and points of interest. These POIs aren't necessarily causing relationships to form, however they are correlated with a higher number of relationship indicators in the country. The institutions tested in this study act as "ad hoc" relationships; In the context of this study, this means relationships most likely formed for the purpose of integration into the region. The notion of bridging social capital, or relationships between different social groups, can also be said to be correlated with a higher number of these institutions in Turkey.

The institutions tested as points of interest in this study were chosen because they were thought to have a positive connotation with the sense of community in a region. The consistency of the results leads to the conclusion that these institutions are in fact positively correlated with a heightened level of community. The significance of the results makes these findings stand out, as the majority of the averages between the sample groups and the Turkish group of interest were drastically different. This leads to the conclusion that the communities in which the Turkish population contributing to refugee integration reside in have many more resources in the form of institutions available to aid in communication between groups, although once again conclusions cannot be drawn for if these resources are causing the successful integration and heightened social capital in Turkey.

While neither of the variables distance to border crossing sites (meters) and distance to refugee camps (meters) scored statistically significant, the trials do provide insight into the characteristics of the social capital in Turkey. The average distances for the Turkish group of interest are rather large, as are the distances pertaining to the sample groups; this indicates that neither party is statistically closer to designated refugee sites. From these distances, one can conclude that the Turkish population contributing to social capital in Turkey doesn't tend to help out at the border or at refugee camps. Another important consideration that could impact the interpretation of these results is that the majority of Syrian refugees don't actually settle in refugee camps; as mentioned earlier in the study, 95% of Syrian refugees have settled in urban areas as opposed to designated camps (Kirişci et al. 2018).

While over half of the religion variables in this study scored statistically significant as having a higher count per activity space for active Turks versus the sample groups, these results should be interpreted with caution; active Turks had a drastically higher number of places of worship in their activity spaces in general, so it is not surprising that certain religions also have a higher count for active users versus the sample groups. It is also not surprising that the dominant religion classes in these activity spaces were Muslim and Muslim-Sunni; as mentioned earlier, the vast majority of both Turks and Syrians are Muslim or Muslim-Sunni. Consequentially, it makes sense that the majority of Turks who have heightened interaction with refugees would have a high number of places of worship in their activity spaces; these locales represent common grounds between both populations, where both the Turkish population and Syrian refugees share similar beliefs/interests. The statistical significance and drastic difference in means supports the notion that places of worship of the Muslim and Muslim-Sunni religion class were most correlated with social capital throughout Turkey for the year 2017.

Summary of the Relevance of Results

As the Syrian Refugee Crisis continues to intensify, policy makers and local governments of the communities hosting these refugees become more and more desperate for insight into how to help these refugees successfully integrate into their countries. From this, it has become increasingly important to uncover patterns and rules that have historically helped refugees to integrate into a country. Aspects of integration, such as supporting infrastructure, act to facilitate social capital and thus relationships in a community. This paper shows the correlation between infrastructure used to support social capital and the heightened level of bridging social capital in an area. More specifically, this paper demonstrates the relationship between bridging social capital and places of worship for Muslim and Muslim-Sunni followers. This religion represents a fundamental shared belief between both the Turkish population and Syrian refugees. The Turkish government as well as policymakers should recognize that this shared interest is one of the factors most highly correlated with bridging social capital in Turkey, and use it to inform future decisions and to adapt a long-term integration strategy. It may be possible to ease refugee integration in Turkey in the future by using this information to facilitate bridging social capital and the creation of relationships between two distinct groups.

Future Directions for Research

This study provided groundwork for the identification of socio-environmental variables correlated with heightened refugee integration in Turkey. Only correlation can be empirically concluded from this study. However, a causation question arises: Did these institutions cause active callers to become active, or did active callers choose to locate in regions where these

institutions are present? There also exists the possibility that communities of active callers attracted certain types of institutions. This research could be expanded in multiple directions in order to further investigate the question of causation in this study.

This research could also be expanded to identify more variables found to correlate with integration. Using additional demographic data to describe districts and cities with heightened interaction between the Turkish population and refugees could provide further insight into the specifics of the locales correlated with integration. Levels of education, voting patterns, income, and other socio-economic data are possible avenues that could help to describe environments conducive to refugee integration in Turkey. A possible challenge regarding this research is the availability of data on a regional level, as this data is currently widely unavailable.

Moreover, research could be conducted in other countries and regions that act as “hotspots” for refugees; Jordan and Lebanon also host a large number of Syrian refugees, and it may be helpful to aid refugees by comparing the environments in which social capital and integration is prevalent in these countries to Turkey. A possible drawback to this research is that call-detail record data may be unavailable for these countries, and few other avenues exist to measure social capital or the level of communication in a region. As more detailed demographic data and a larger number of call-detail record datasets become publicly available however, these directions for research could provide valuable insight into the topic of integration and help advance the literature pertaining to migration policy and strategy.

Appendix

Table 4: Refugee Call Summary Statistics

| | Turk Callee | Unknown Callee | Refugee Callee | Total Calls | Percent Calls from Refugees to Turks |
|--------|-------------|----------------|----------------|-------------|--------------------------------------|
| MIN | 0 | 0 | 0 | 1.00 | 0 |
| MEDIAN | 1.00 | 3.00 | 0 | 6.00 | 0.1905 |
| MEAN | 5.499 | 5.822 | 0.4162 | 11.74 | 0.345 |
| MAX | 994.00 | 286.00 | 329.00 | 1086.00 | 1.00 |

Table 5: Turk Call Summary Statistics

| | Turk Callee | Unknown Callee | Refugee Callee | Total Calls | Percent Calls from Turks to Refugees |
|--------|-------------|----------------|----------------|-------------|--------------------------------------|
| MIN | 0 | 0 | 0 | 1.00 | 0 |
| MEDIAN | 4.00 | 4.00 | 0 | 13.00 | 0 |
| MEAN | 13.35 | 10.88 | 9.72e-03 | 24.24 | 0.0004168 |
| MAX | 925.00 | 780.00 | 224.00 | 946.00 | 1.00 |

Table 6: Calls by Active Turks

| Total Calls by Active Turks | Total Calls to Refugees by Active Turks | Percent Calls to refugees by Active Turks |
|-----------------------------|---|---|
| 28,288 | 6,170 | 0.2181 |

Table 7: Total Calls by Active Turks

| | Turk Caller |
|----------------|-------------|
| Refugee Callee | 6,170 |
| Turk Callee | 17,531 |
| Unknown Callee | 4,587 |

Table 8: Active Turk Call Summary Statistics

| | Turk Callee | Unknown Callee | Refugee Callee | Total Calls | Percent Calls from Turks to Refugees |
|--------|-------------|----------------|----------------|-------------|--------------------------------------|
| MIN | 0 | 0 | 10.00 | 12.00 | 0.0186 |
| MEDIAN | 36.00 | 10.50 | 16.00 | 72.00 | 0.2653 |
| MEAN | 61.30 | 16.04 | 21.57 | 98.91 | 0.3176 |
| MAX | 468.00 | 125.00 | 224.00 | 538.00 | 1.00 |

Table 9: Places of Worship

| Trial | Active Turk Mean | Sample Turk Mean | P-Value | T-Value |
|-------|------------------|------------------|-----------|---------|
| 1 | 39.99611 | 16.17131 | 9.05e-08 | 5.439 |
| 2 | 39.99611 | 15.58779 | 9.9e-09 | 5.8637 |
| 3 | 39.99611 | 19.05534 | 2.141e-06 | 4.8064 |
| 4 | 39.99611 | 12.39442 | 2.598e-11 | 6.9024 |
| 5 | 39.99611 | 19.36719 | 2.492e-06 | 4.7755 |

Table 10: Schools

| Trial | Active Turk Mean | Sample Turk Mean | P-Value | T-Value |
|-------|------------------|------------------|-----------|---------|
| 1 | 37.67803 | 19.14463 | 6.283e-06 | 4.5704 |
| 2 | 37.67803 | 18.49597 | 9.354e-07 | 4.9806 |
| 3 | 37.67803 | 21.63889 | 9.178e-05 | 3.9463 |
| 4 | 37.67803 | 13.96386 | 2.094e-10 | 6.5501 |
| 5 | 37.67803 | 23.07631 | 0.0003496 | 3.6027 |

Table 11: Community Centers

| Trial | Active Turk Mean | Sample Turk Mean | P-Value | T-Value |
|-------|------------------|------------------|-----------|---------|
| 1 | 6.315789 | 4.083333 | 0.0001052 | 3.9428 |
| 2 | 6.315789 | 4.264000 | 0.0002051 | 3.7715 |
| 3 | 6.315789 | 4.318519 | 0.0004073 | 3.5839 |
| 4 | 6.315789 | 3.449541 | 2.158e-07 | 5.3506 |
| 5 | 6.315789 | 4.500000 | 0.0009799 | 3.3371 |

Table 12: Social Centers/Facilities

| Trial | Active Turk Mean | Sample Turk Mean | P-Value | T-Value |
|-------|------------------|------------------|-----------|---------|
| 1 | 9.715789 | 4.285714 | 1.722e-08 | 5.9222 |
| 2 | 9.715789 | 4.136986 | 1.602e-10 | 6.8393 |
| 3 | 9.715789 | 4.666667 | 1.204e-08 | 5.9898 |

| | | | | |
|---|----------|----------|-----------|--------|
| 4 | 9.715789 | 3.274194 | 4.182e-13 | 7.9373 |
| 5 | 9.715789 | 4.247423 | 1.604e-10 | 6.8236 |

Table 13: Distance to Refugee Camps (Meters)

| Trial | Active Turk Mean | Sample Turk Mean | P-Value | T-Value |
|-------|------------------|------------------|---------|-----------|
| 1 | 412116.4 | 421852.5 | 0.6716 | -0.42424 |
| 2 | 412116.4 | 376659.6 | 0.1247 | 1.5378 |
| 3 | 412116.4 | 413123.9 | 0.9652 | -0.043646 |
| 4 | 412116.4 | 370519.9 | 0.07527 | 1.782 |
| 5 | 412116.4 | 427131.9 | 0.511 | -0.65769 |

Table 14: Distance to Border Crossing Sites (Meters)

| Trial | Active Turk Mean | Sample Turk Mean | P-Value | T-Value |
|-------|------------------|------------------|---------|----------|
| 1 | 476797.9 | 495520.3 | 0.4539 | -0.74941 |
| 2 | 476797.9 | 443610.4 | 0.1891 | 1.3147 |
| 3 | 476797.9 | 483584.5 | 0.7877 | -0.26936 |
| 4 | 476797.9 | 437219.1 | 0.1219 | 1.549 |
| 5 | 476797.9 | 496177.0 | 0.4391 | -0.77429 |

Table 15: Places of Worship- Christian

| Trial | Active Turk Mean | Sample Turk Mean | P-Value | T-Value |
|-------|------------------|------------------|-----------|---------|
| 1 | 3.602787 | 1.155932 | 1.546e-07 | 5.3272 |
| 2 | 3.602787 | 0.9932203 | 2.367e-09 | 6.1151 |
| 3 | 3.602787 | 1.284746 | 3.686e-07 | 5.1619 |
| 4 | 3.602787 | 0.8101695 | 1.279e-10 | 6.617 |

Table 16: Places of Worship- Christian-Catholic

| Trial | Active Turk Mean | Sample Turk Mean | P-Value | T-Value |
|-------|------------------|------------------|-----------|---------|
| 1 | 0.7073171 | 0.2610169 | 7.765e-06 | 4.5192 |
| 2 | 0.7073171 | 0.2372881 | 7.287e-07 | 5.0265 |
| 3 | 0.7073171 | 0.2813559 | 1.714e-05 | 4.3422 |
| 4 | 0.7073171 | 0.2406780 | 1.087e-06 | 4.9432 |
| 5 | 0.7073171 | 0.3423729 | 0.0003137 | 3.6284 |

Table 17: Places of Worship- Christian-Orthodox

| Trial | Active Turk Mean | Sample Turk Mean | P-Value | T-Value |
|-------|------------------|------------------|---------|-----------|
| 1 | 0.04878049 | 0.05084746 | 0.9342 | -0.082601 |

| | | | | |
|---|------------|------------|---------|---------|
| 2 | 0.04878049 | 0.02711864 | 0.2273 | 1.2087 |
| 3 | 0.04878049 | 0.01694915 | 0.03196 | 2.1514 |
| 4 | 0.04878049 | 0.04406780 | 0.8561 | 0.18146 |
| 5 | 0.04878049 | 0.05464324 | 0.3424 | 0.23244 |

Table 18: Places of Worship- Muslim

| Trial | Active Turk Mean | Sample Turk Mean | P-Value | T-Value |
|-------|------------------|------------------|-----------|---------|
| 1 | 13.554007 | 7.047458 | 4.04e-06 | 4.6646 |
| 2 | 13.554007 | 4.938983 | 1.149e-10 | 6.6284 |
| 3 | 13.554007 | 6.772881 | 1.614e-06 | 4.8587 |
| 4 | 13.554007 | 6.061017 | 5.224e-08 | 5.5413 |
| 5 | 13.554007 | 5.867797 | 7.635e-08 | 5.4608 |

Table 19: Places of Worship- Muslim-Sunni

| Trial | Active Turk Mean | Sample Turk Mean | P-Value | T-Value |
|-------|------------------|------------------|-----------|---------|
| 1 | 11.303136 | 4.277966 | 1.522e-07 | 5.3337 |
| 2 | 11.303136 | 4.064407 | 2.891e-08 | 5.6546 |
| 3 | 11.303136 | 5.454237 | 1.869e-05 | 4.3232 |
| 4 | 11.303136 | 2.925424 | 2.881e-11 | 6.8669 |
| 5 | 11.303136 | 5.176271 | 4.807e-06 | 4.6282 |

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ACADEMIC VITA

Brynne Godfrey

Schreyer Honors Scholar • Paterno Fellow • PSUEA Coordinator of Research

EDUCATION

The Pennsylvania State University, University Park, PA May 2019

Schreyer Honors College- Paterno Fellows Program

Bachelor of Science in **Economics**

Bachelor of Arts in **International Politics**, concentration in International Relations

Minor in Spanish

**Received Edward E. Elias award for highest transfer-student GPA*

Study Abroad Experience

IES Abroad, Barcelona, Spain

May- July 2017

Barcelona Language and Area Studies Program

ECONOMICS/DATA ANALYSIS EXPERIENCE

Penn State Administrative Data Accelerator

University Park, PA

Research Assistant

February 2019- May 2019

- Train machine-learning model to automate matching of healthcare records
- Analyze administrative data from variety of government sources

Penn State- College of Communications/Information Sciences and Technology

University Park, PA

Data Analyst and Web Designer

November 2018- February 2019

- Utilize Spanish and foreign area expertise to geolocate lands repossessed by the Colombian government
- Implement Tableau along with spatial analysis and web development software to visualize and present findings

Penn State Friendly Cities Lab

University Park, PA

Research Assistant

October 2018- May 2019

- Use R for data mining and to conduct social network analysis on over 60 million call-detail records from Turkey
- Use ArcGIS to develop maps and visual aids to explain research and gain insight on socio-environmental variables pertaining to region

The Pennsylvania State University- Department of Economics

State College, PA

Research Assistant

January 2018- August 2018

- Implemented Stata Python, R, and ArcGIS to conduct international development research
- Assembled and generated datasets while under short time constraints

The World Trade Center Harrisburg

Harrisburg, PA

Statistical Analysis and Economic Impact Intern

May- August 2018

- Published report analyzing the impact of trade and other economic accounts pertaining to the Southcentral Pennsylvania region
 - Prepared reports addressing requests for specific country information
 - Conducted foreign market research to look at economic accounts, along with trade and business trends
-

LEADERSHIP EXPERIENCE

The Pennsylvania State University Economics Association

University Park, PA

Project Management Coordinator- Research Division

June 2018- May 2019

- Guide team of associates through economic consulting projects with local start-ups and the Penn State Federal Credit Union
 - Conduct original surveying and data collection for economic evaluation, followed by data analysis using STATA and R
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SKILLS

- Technical: SPSS, Stata R, Python, MATLAB, ArcGIS, Microsoft Office, Git Source Control, Tableau, WordPress
- Spanish- professional working ability
- Export Procedures Certification- for trade specialization
- Relevant Coursework: Honors Thesis in Economics, Honors Economic Forecasting, Advanced Econometrics, Regression Analysis, C++, Teaching Assistant for Intermediate Macroeconomics (ECON 304)