THE IMPACT OF IMIGRANTS ON ILLEGAL ELECTRICITY CONSUMPTION: CASE OF SYRIAN IMMIGRANT IN TURKEY

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF SOCIAL SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

AKIN CAN GENÇ

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF MASTER OF SCIENCE
IN
THE DEPARTMENT OF ECONOMICS

JANUARY 2021

Approval of the thesis:

THE IMPACT OF IMMIGRANTS ON ILLEGAL ELECTRICITY CONSUMPTION: CASE OF SYRIAN IMMIGRANTS IN TURKEY

submitted by **AKIN CAN GENÇ** in partial fulfillment of the requirements for the degree of **Master of Science in Economics, the Graduate School of Social Sciences of Middle East Technical University** by,

Prof. Dr. Yaşar KONDAKÇI
Dean
Graduate School of Social Sciences _____

Prof. Dr. METEM TAYFUR-DAYIOĞLU
Head of Department
Department of Economics _____

Assoc. Prof. Dr. Pınar DERİN-GÜRE
Supervisor
Department of Economics _____

Examining Committee Members:

Prof. Dr. Jülide YILDIRIM-ÖCAL (Head of the Examining Committee)
TED University
Department of Economics _____

Assoc. Prof. Dr. Pınar DERİN-GÜRE (Supervisor)
Middle East Technical University
Department of Economics _____

Prof. Dr. Ramazan SARI
Middle East Technical University
Department of Business Administration _____

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Last Name: Akın Can GENÇ

Signature:

ABSTRACT

THE IMPACT OF IMMIGRANTS ON ILLEGAL ELECTRICITY CONSUMPTION: CASE OF SYRIAN IMMIGRANTS IN TURKEY

GENÇ, Akın Can
M.S., The Department of Economics
Supervisor: Assoc. Prof. Dr. Pınar DERİN-GÜRE

January 2021, 55 pages

Electricity is necessity for daily needs in today's condition and it has gained so much importance. Accordingly, illegal electricity consumption is a crucial situation in both developing and developed countries and this thesis aims to find the relationship between immigration and illegal electricity consumption. In this study, we use panel data and difference in differences estimation methods. Due to the fact that Turkey has random immigration influx and the majority of immigrants' population in Turkey consists of Syrian immigrants, we take Syrian immigrants in Turkey as a case study. We use data of electricity theft and loss rate of 27 provinces and their socio-economic data for the period of 2009 -2016. Using the panel data fixed effects and difference in differences methods we mainly find that immigrant influx has an important impact on illegal electricity consumption. Moreover, unemployment rate, privatization, population density and amount of agricultural land have significant effects on illegal electricity consumption in our models.

Keywords: Panel Data, Difference in Differences, Immigration, Immigrant Inflow

ÖZ

MÜLTECİLERİN TÜRKİYE'DEKİ KAÇAK ELEKTRİK KULLANIMINA ETKİLERİ: TÜRKİYEDEKİ SURİYELİ GÖÇMEN ANALİZİ

GENÇ, Akın Can
Yüksek Lisans, İktisat Bölümü
Tez Yöneticisi: Assoc. Prof. Dr. Pınar DERİN-GÜRE

Ocak 2021, 55 sayfa

Elektrik, günümüz koşullarında günlük ihtiyaçların bir gereğidir ve çok fazla önem kazanmıştır. Dolayısıyla, kaçak elektrik tüketimi de hem gelişmekte olan hem de gelişmiş ülkelerde önemli bir durumdur ve bu tez, göç ile kaçak elektrik tüketimi arasındaki ilişkiyi bulmayı amaçlamaktadır. Bu çalışmada, panel verilerini ve farklılık tahmin yöntemlerini kullanıyoruz. Türkiye'nin gelişigüzel göçmen akını olması ve Türkiye'deki göçmen nüfusunun çoğunluğunun Suriyeli göçmenlerden oluşması nedeniyle, Suriyeli göçmenleri bir vaka çalışması olarak ele alıyoruz.27 ilin elektrik kayıp kaçak oranlarını ve 2009-2016 dönemine ait sosyo-ekonomik verilerini kullanıyoruz. Panel veri ve farklılıklardaki farklılık yöntemlerini kullanarak, esas olarak 2012 yılında Türkiye'ye göçmen akınının Türkiye'deki kaçak elektrik tüketimi üzerinde önemli bir etkisi olduğunu bulduk. Ayrıca modellerimizde işsizlik oranı, özelleştirme, nüfus yoğunluğu ve tarımsal arazi miktarı kaçak elektrik tüketimi üzerinde önemli etkiye sahip olduğunu tespit ettik.

Anahtar Kelimeler: Panel Veri, Farkların Farkı, Göç, Göç Akını

To my family

ACKNOWLEDGMENTS

I would like to thank my thesis advisor Assoc. Prof. Dr. Pınar Derin - Güre for her contributions and support during my study. I would also like to thank to the other members of my thesis committee Prof. Dr. Ramazan Sarı and Prof. Dr. Jülide Yıldırım – Öcal for their insightful comments and assistance.

Finally, I would like to thank my parents and my brother for their endless support that I constantly felt throughout all my life.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

Electricity is a necessity for daily needs in today's condition and it has gained so much importance. The per capita consumption of electricity has been growing ever year in the world with the improvements in technology and the effect of electricity consumption on the economy is becoming more and more important for countries. On the other hand, illegal electricity consumption is an exhaustive situation in both developing and developed countries, but according to Bhattacharyya (2005), there is a difference in electricity theft ratios in developed and developing countries. The theft rate in the US and West Europe is roughly 1-2%. However, developing countries such as India, Malaysia, and Bangladesh have higher electricity theft ratio. Turkey is one of these countries and according to Electricity Market Development Report 2019, it has average 11,4 % electricity theft and loss ratio and this caused the loss of billions TL in 2019 for Turkey. Also, according to Electricity Generation Company's sector report, at the end of 2019, 19.96% of the electricity produced in Turkey is composed of imported coal and 18.40% is based on imports of natural gas, so Turkey has an approximately 38% foreign dependency in electricity production. Therefore, the current account deficit, which creates fragility on the economy, has an important share in energy imports. When wasteful energy consumption is prevented, energy imports will decrease and a positive effect will occur on the country's economy.

The aforementioned reasons mainly indicate the significance of energy independency and electricity consumption for the economy. Thus, it also becomes important to understand the effects of illegal electricity consumption. It has mainly various effects: first, reduction in government revenue decreases due to the fact some electric powered payments are not paid. Second, the earnings of electricity distribution companies decrease because of not only less payment they received but also the extreme

consumption could give rise to technical problems such as power cuts and voltage fluctuations which could cause devices to fail in the factory. Third, the introduction of the feel of injustice for people who pay their bills regularly emerges. Furthermore, it undertakes covering the unpaid bills of others; and a loss of investment within the electricity sector (Kumar, 2004). Especially, after the privatization of the electricity distribution sector, private companies try to find methods to prevent electricity theft to increase their profit. In that sense, authorities can simply increase the price of electricity so as to cover the illegal electricity consumption to cover their loss. Therefore, understanding the determinants of electricity theft or illegal electricity consumption is essential and this could help companies to prevent illegal consumption. Also, this could save social justice by preventing illegal movement and have an effect on investment decisions and consequently on the growth of the economy. The prevention efforts for this illegal action, which has underlying socio-economic causes, is predicted to be effective best via a collaborative work of the companies and the government. Therefore, governments and companies pay attention to handle electricity theft problem and take precautions.

According to United Nations International Migration Report 2017, the number of international migrants worldwide is 258 million in 2017 and Turkey is one of the host countries for refugees. It is clear that refugee influx may have significant impacts on the Turkish economy including the labor market, inflation, regional economic activities, public budget and economic growth. In that sense, Ceritoğlu et al.(2015) and Tümen (2016) examine the impact of refugees on natives' labor market outcomes in Turkey and they find that there is a significant effect on the labor market. Moreover, according to European Union Energy Initiative Partnership Dialogue Facility Report (2017), refugees often face severe conditions and lack of access to energy could be an important problem for refugees. Without access to energy, it becomes more difficult to fulfill daily needs like heating, cooking food, health and education services. So, immigrants need to use electricity to fulfill their daily needs and it might affect the illegal electricity consumption in Turkey due to severe conditions of immigrants and sudden population growth which makes it difficult to control illegal electricity consumption.

In this study, we aim to find the relationship between immigration and illegal electricity consumption. As far as we know, this study is the first paper on the impact of immigration on electricity consumption. We use panel data and difference in differences estimation methods. Using the panel data fixed effects and difference in differences methods, we find that the immigrant influx to Turkey in 2012 had an important impact on illegal electricity consumption in Turkey. Due to the fact that Turkey has random immigration influx and the majority of immigrants' population in Turkey consists of Syrian immigrants, we take Syrian immigrants as a case study. We use data on electricity theft and loss rate of 27 provinces and their socio-economic data for the period of 2009 -2016.

CHAPTER 2

REVIEW OF LITERATURE

Illegal electricity consumption is one of the major socio-economic problem in the world and many studies have attempted to come up with different policy recommendations. Firstly, we will give an information about the studies which are related to electricity theft in Turkey. After that, we will give an information about the other countries which have higher theft and loss ratio like Pakistan, Indian and Latin American Countries. Finally, we will review the literature about effect of refugees on Turkish economy which will be beneficial for our study.

Gümüşdere (2004) examines the determinates of electricity theft and losses which show great differences across different cities of Turkey, and tries to explain impact of the electricity theft and losses on tariff design and privatization process of the electricity distribution. Author analyzes the period of 1994 to 2001 and uses many independent variables in his regression which are divided into 6 categories: Economic Variables, Variables Reflecting the Enforcement Capacity and the Reach of the State, The State and Authority Related Variables, Distribution Utility's Managerial Variables, Physical Variables, and Dummy Variables. He especially finds that, vote ratio of HADEP which was powerful political party in Southeastern Anatolia Region, transformer utility ratio, residential electricity consumption, and the tax to GDP ratio are significant and positive effect on electricity theft and losses. Also, he finds that income is not significant factor in his regression but it has positive relation which might suggest giving subsidies to poor cities will not be useful option to decrease the cost of theft and losses. On the other hand, Yurtseven (2015) finds that income is significant determinant of in electricity consumption. Yurtseven (2015) uses data for the period of 2002 – 2010 for Turkey and panel data method is used in the regression. Author's study shows that several factors have a relation between illegal electricity consumption in developing countries like Turkey. Education, income, social capital, rural population rate, temperature index, and agricultural production rate are crucial

factors for illegal electricity consumption. According to his study, education, income and social capital have negative impact on illegal electricity consumption and others have positive impact. Moreover, Marangoz (2013) concludes that education have negative impact on illegal electricity consumption. The author suggests the government to increase educational investment and usage of smart meters. Additionally, political parties, unemployment rate and population do not affect illegal electricity consumption but terrorist attacks have positive effect on electricity theft in Turkey. Further, Tasdoven (2012) investigates same topic for Turkey and the author analyzes for governance tools in the study like: economic regulation, privatization, grants and public information. The paper suggests that privatization is the suitable method to manage stated policy about electricity theft. On the other hand, it might be argued that current market structure needs more extensive regulations which design the system to free market status because these mechanisms are considerably absent in the current arrangements. Therefore, the author suggests that permanent addition of grants and public information will increase the effectivity of privatization process in the electricity sector. Differently from previous literature, in this study we aim to understand the effect of immigration and privatization process.

There is also a vast literature on electricity theft and loss. Especially, Pakistan, Indian and Latin American countries have suffered from electricity theft like Turkey, so analyzing these countries could be helpful for our model. Mirza (2015) tries to estimate the long run relationship between illegal electricity consumption and its determinants for Pakistan. Author analyzes the period of 1971 to 2010 in the study and ARDL approach is used to test the existence long-run relationship between the electricity theft and independent variables. The study concludes that per capita income has negative effect on electricity theft and it is significant. So, the possibility of using illegal electricity is higher in the area of lower income groups in Pakistan. Moreover, electricity price and number of consumers are significant and there exists a positive relation with electricity theft in the long-run. The study suggests that government should establish a strong electricity regulatory authority in Pakistan and increase the competition among electricity distribution companies for better service and distribution system to resolve the problem.

Golden and Min (2012) study about electricity theft and loss in an Indian State for 2000-2009. The study shows that there is a relationship between agriculture and electricity theft and loss. If agricultural activities are higher in a region, there is more electricity theft in there. The paper claims that wealthy tube-well-owning farmers could impact politicians to reduce their electric bills because they have a power to control the votes of the poorer villagers. Moreover, Saini (2016) examines the different socio-economic factors of electricity theft in Indian State and finds that agricultural activities has positive impact on illegal electricity consumption and it is significant in his regression. Also, author finds that tariff rate, population, unemployment, corruption, political intervention, and temperature have a positive impact on electricity consumption, too. On the other hand, collection efficiency, literacy, urbanization, income, law & order, system efficiency, probability of detection and fine amounts have a negative impact on illegal electricity consumption.

Gaur, (2016) investigates the impacts of socio-economic and governance factors on electricity thefts in Indian states. 28 states are included and the period of 2005 to 2009 is analyzed in the study. Author uses electricity prices, per-capita income, urbanization, poverty, literacy rate, rate of urban unemployment, structure of the economy, infrastructural investment and total population as a social economic factor. Also, the author considers state's enforcement capacity, taxes and bills collecting ratio and the rule of law as a governance factor. Finally, the author finds that good governance indicators have significantly negative effects on illegal electricity and he suggests that increasing transparency and honesty is very important to decrease losses and improving collective efficiency. Also, Smith (2004) analyzes the effect of the governance indicators on the illegal electricity usage and finds similar result. Author uses data from 102 countries for 1980 - 2000 and concludes that governance indicators are crucial to explain the different theft related behaviors in different countries. Author finds that electricity theft is higher in the countries which have a poor governance. Because, poor governance lead to cultural corruption and create the cultural environment to use illegal electricity.

Andres, Foster and Guasch (2006) analyze the effect of the privatization on electricity distribution’s infrastructure in Latin American Countries. Authors find that

privatization leads to a significant increase labor productivity, efficiency, and service quality in electricity distribution system. Moreover, Birdsall and Nellis (2003) suggest that all developing and transitional countries should privatize their distributional services which lead to obtain better and efficient infrastructure. Therefore, we will examine the impact of the privatization on electricity theft and losses and we expect that there is negative relationship between privatization and theft and losses.

The main contribution of this thesis is to find the impact of immigration on illegal electricity consumption and we take Syrian immigrants in Turkey as a case study as Syrian immigrants because Turkey hosts around 4 million refugees, while around 3.6 million of them are Syrian Refugees and they became the largest immigrant population in Turkey. Therefore, we also investigated the literature on immigration and especially Syrian Immigration on Turkish economy. Ceritoğlu et al.(2015) and Tümen (2016) study the impact of Syrian refugees on natives' labor market outcomes in Turkey. Although, the Syrian refugees did not have a formal work permit, they supplied inexpensive informal unskilled labor. Ceritoğlu et al.(2015) analyzes 10 different cities which have Syrian refugees in 2013. The study concludes that refugee inflows had noticeable impacts on the Turkish labor market. Especially, results show that refugees have reduced the ratio of informal employment to population by approximately 2.2 percentage points. On the other hand, authors could not find any statistically significant impact of immigrant inflow on wages. According to the study, the Syrian refugees do not have a formal work permit and most of them are uneducated so they can only affect Turkish labor market through informal employment. Also, Tümen (2016) shows that the employment to population ratio declines by 1.8 percentage due to Syrian refugees and refugee inflows affect consumer prices negatively and it declines by 2,5 percent. On the other hand, author shows that effect of the refugee inflows on the wage earnings of the native individuals is not significant. Finally, the author concludes that the Syrian refugee inflows have many impacts on economy, social life and politics, and there will be a lot of new research about this topic. Moreover, Aksu, Erzan and Kırdar (2018) use a difference-in-differences method to analyze the impact of Syrian immigration on the Turkish labor market. Authors conclude that there is no negative effect of Syrian influx on the total employment of men and native men's wage in the aggregate labor market. The

significant negative effect on informal employment is offset by an equally significant positive effect on formal employment for native men. Also, wages of native men increase but their wage- earning employment decreases and this could show that Syrians remove native men in low-paying jobs. On the other hand, total employment decreases for native women because of losing part-time jobs but wages of native women increase. In additon, Del Carpio and Wagner (2016) also examine the impacts of Syrian migrants on labor market in Turkey by using difference-in-differences analysis with the 2011-2014 Household Labor Force Surveys. Authors conclude that informal, low educated, female Turkish workers are displaced by Syrians, especially in agriculture. Also, Syrian influx causes higher wage formal jobs Turkish workers, and school attendance of women increase. Therefore, native workers try to find formal jobs and average of Turkish wages rise. Lastly, Cengiz and Tekgüç (2018) examine the impacts of Syrian migrants on labor market in Turkey by using difference-in-differences and synthetic control methods with the 2004–2015 Household Labor Force Surveys. Authors find that Syrian refugees are involved the labor force through informal employment and this brings a reduction in the average wage of informal jobs. On the other hand, native workers try to find formal jobs which pay relatively higher wages and native workers are protected from the potential negative wage effects. When we review the literature, there is no study about effect of refugees on electricity theft and definitely no study on the special case of Syrian immigrants in Turkey so this study will differ in this regard.

CHAPTER 3

DATA AND ESTIMATION METHODS

After the outbreak of Syrian civil war, Syrians have started to immigrate and this immigrant inflow affected the world in many ways. This study tries to understand the effect of this immigrant inflow on illegal electricity consumption in Turkey. In this section, we explain the method of the model and independent variables that are useful for understanding of the problem. The explanatory variables are unemployment rate, education rate, per capita income, population density, our variable of interest refugee rate, agricultural land amount and effect of the privatization.

Following the literature about illegal electricity consumption, this study is trying to question if refugees have effect on electricity theft and loss across the 27 provinces in Turkey in the period of the 2009 to 2016. Unfortunately, other provinces could not be included in the analysis because of their missing electricity theft and loss rations in some years. However, data of provinces which have higher refugees' rate are available and they are included in the analysis.

Number of refugees in the provinces is taken from Turkey Ministry of Interior Directorate General of Migration Management. Provinces' unemployment rate, education rate, per capita income, population density, and amount of agricultural land are taken from Turkish Statistical Institute. Theft and loss ratios of provinces taken from Republic of Turkey Energy Market Regulatory Authority, Turkish Electricity Distribution Corporation Reports and electricity distribution companies.

Before analyzing the model, characterizing panel data for theft-losses ratio and explanatory variables will be beneficial. Some descriptive statistics will be given in this part to understand the structure of dependent and explanatory variables. As we mentioned before, panel data includes 8 years from 2009 to 2016 and 27 provinces of Turkey where the data is available.

Table 3.1. shows the theft and loss ratio of 27 provinces. Distribution companies buy the energy from the transmission company and the difference between the sum of the amount invoiced by the electricity distribution company and the energy delivered by the transmission company is amount of electricity theft and loss. The ratio of this amount to total energy delivered by the transmission company is theft and loss ratio. When we examine the dependent variable, average value of theft-loss ratio over 8 years across 27 provinces is 20.68% as seen on Table 3.1 below. Another crucial issue is variability of the data. Standard deviation of the dependent variable is 0.2367. The minimum value of Theft and Loss Rate is 2.3% and the maximum value of TLR is 88.56% for whole sample.

For cross sectional averages of provinces: Karabük, Erzincan, Osmaniye, Kırıkkale and Kayseri have minimum theft and loss ratios in this group. On the other hand, Especially, provinces of Southeastern Anatolia Region have higher electricity theft and loss ratio than other provinces. Mardin, Şırnak, Diyarbakır and Şanlıurfa have maximum theft and loss ratios in this group.

Table 3.1. Electricity Theft and Loss Ratio of Provinces

PROVINCES	2009	2010	2011	2012	2013	2014	2015	2016
ADANA	8,20%	8,50%	13,40%	11,20%	12,13%	9,06%	8,69%	9,71%
ANKARA	8,77%	8,44%	9,06%	8,23%	7,96%	7,71%	6,92%	7,04%
ARTVİN	17,10%	11,00%	12,08%	11,75%	12,16%	13,38%	10,49%	10,50%
BARTIN	9,83%	9,50%	9,26%	8,98%	6,07%	5,90%	6,52%	6,21%
BAYBURT	8,10%	10,90%	12,20%	14,10%	20,40%	9,34%	10,16%	2,48%
ÇANKIRI	7,56%	7,23%	7,82%	7,63%	6,13%	5,96%	6,55%	6,23%
DİYARBAKIR	70,50%	70,50%	72,30%	73,30%	76,69%	69,49%	70,03%	65,70%
ERZİNCAN	5,90%	4,90%	6,00%	6,90%	9,30%	6,33%	5,67%	7,67%
GAZİANTEP	8,50%	7,00%	14,21%	13,20%	14,69%	14,91%	14,31%	13,02%
GİRESUN	15,30%	18,70%	14,68%	13,64%	11,77%	14,77%	13,65%	13,82%
GÜMÜŞHANE	10,10%	10,20%	9,80%	6,03%	4,92%	11,67%	5,32%	4,84%
HATAY	7,00%	7,80%	10,90%	15,40%	26,10%	24,11%	22,90%	19,43%
KARABÜK	4,17%	3,82%	8,69%	4,91%	6,21%	6,04%	5,79%	6,06%
KARS	22,60%	21,90%	25,70%	21,70%	26,10%	21,25%	20,72%	14,94%
KASTAMONU	8,20%	7,87%	8,36%	11,54%	8,07%	7,84%	7,14%	7,40%
KAYSERİ	6,97%	8,74%	7,12%	6,89%	6,85%	6,95%	5,25%	5,87%
KIRIKKALE	5,10%	8,50%	8,65%	5,82%	6,73%	6,54%	6,51%	6,19%
KİLİS	9,70%	7,80%	8,50%	7,20%	14,14%	10,67%	10,13%	8,24%
MARDİN	79,00%	73,50%	76,10%	76,00%	88,56%	86,25%	84,34%	74,19%

Table 3.1. (cont'd)

MERSİN	10,60%	10,80%	14,20%	11,80%	12,98%	9,28%	8,80%	9,15%
OSMANİYE	5,30%	2,30%	7,42%	9,10%	6,22%	6,00%	6,70%	9,71%
RİZE	8,30%	6,50%	7,61%	7,45%	7,69%	7,98%	6,03%	5,90%
SİİRT	40,60%	43,30%	48,60%	41,40%	51,93%	63,52%	37,04%	35,91%
ŞANLIURFA	76,00%	55,20%	67,60%	63,60%	77,39%	67,52%	67,61%	65,62%
ŞIRNAK	70,70%	77,40%	81,60%	78,60%	79,12%	68,07%	78,54%	75,14%
TRABZON	10,20%	12,30%	9,92%	9,78%	9,45%	10,21%	9,63%	9,67%
ZONGULDAK	12,91%	12,60%	11,12%	13,22%	9,94%	9,66%	8,66%	7,47%

In power systems, energy losses are divided into two parts as technical and non-technical losses. Technical losses occur because of inefficiencies and managerial practices. Also, electricity is lost while being transmitted and distributed when it passes through transformers. So, technical losses start from the power plants and last until it reaches the consumer. On the other hand, non-technical losses are consumer losses due to the way they use energy. The main causes of these losses are; illegal energy use, unconscious energy consumption and distribution companies' errors during billing process. Today's conditions, it is impossible to distinguish between technical losses and non-technical losses amounts in Turkey. So, electricity theft cannot be measured exactly and we will accept that electricity theft and loss ratio show electricity theft percentages but, we have to keep in mind that the real values could be slightly lower for each city.

Table 3.2. below shows, all independent variables' descriptive statistics. When we analyze the Table 3.2., standard deviations of amount of agricultural land and refugee rate are greater than their means. This means that it has huge variance. On the other hand, standard deviations of GDP, unemployment rate, privatization, population density and education rate are lower than their means and this means that they have small variances. This shows that 27 provinces have homogeneous structure for almost every variable.

Table 3.2. Descriptive Statistics of Independent Variables

Variable	Mean	Std. Dev.	Min	Max	Obs
Refugee Rate	0.03	0.11	0	0.95	216
GDP of Provinces (TL)	861976	1028863	74412	5346518	216
Unemployment Rate	0.10	0.05	0.03	0.28	216
Privatization	0.57	0.49	0	1	216
Amount of Agricultural Land	186838	225420	283	995174	216
Population Density	96.03	69.83	18	290	216
Education Rate	0.81	0.09	0.49	0.94	216

3.1. Method

We will use two different method to analyze the effect of immigration on electricity theft for the special case of Turkey. Panel data and difference in differences estimator methods will be used.

Baltagi (2005) concludes that using of panel data in econometric analysis brings advantages compared to other data types. Firstly, panel datasets contain information about cross sections are heterogeneous so the data set is controlled against heterogeneity. Secondly, multicollinearity problem is encountered in the analysis of the time series, but the values taken by the variables change depending on the two dimensions with panel data analysis and this provides less multicollinearity problems among the explanatory variables in panel data method. Also, this model allows the creation and testing of more complex behavioral models and you can analyze effect of horizontal cross-section data and effect of time series data together. Because of these advantages, we will use panel data method to analyze.

Our second model is difference-in-differences (DID) estimation. DID is a natural experiment method which uses treatment and control groups to evaluate the effect of the event or policy. In this method, we can observe a sample of units before the treatment and after that we observe the same unit after the policy has occurred. So, control group is not affected by the policy and treatment group is affected by the policy

in this model. After the policy is implemented, this method compares the average change over time in the treatment group ‘s and control group’s outcome variable. By using this methodology, we can explore the effect of immigration electricity theft in our model.

Electricity theft and loss ratio is regressed on unemployment rate, education rate, per capita income, population density, refugee rate, agricultural land amount and effect of the privatization.

The panel data regression is as follows:

Theft and Loss Ratio it=Cit+ß1 Unemployment Rateit+ ß2 Education Rateit +ß3 Log(GDPit) + ß4 Population Densityit + ß5 Refugee Rateit + ß6 Log (Agricultural Land Amountit) + ß7Privatization Effectit + εit

where i stands for provinces and t stands for years.

3.2. Explanatory Variables

The first independent variable is income which is the Gross Domestic Product (TL) for every city. There are few ways to understand province’s wealth and prosperity and GDP is one of them. According to literature, there is a negative relationship between income and electricity theft and loss ratio. Poor economic conditions and financial impossibilities cause people not to afford their needs and this encourage people to thieve electricity. Therefore, we expect that high-income cities have a lower electricity theft ratio in Turkey.

The second independent variable we are willing to use is the education rate, which is the number of people who graduated from at least primary school divided by population of the city. Lochner & Moretti (2000) find that increasing the level of education lead people to legal remedies and they have more the characteristics of socially responsible behavior, which could avoid crime. In line with this finding, Marangoz (2013) suggests the government to increase government expenditure on

education to decrease illegal electricity consumption for Turkey. Therefore, we expect that education rate will have negative impact on electricity theft and loss ratio in my model.

The third independent variable is unemployment rate. Turkey has 11% average unemployment rate in last 11 years and this ratio is higher than average of OECD countries and US. When workers are unemployed, they lose their wages, and their contribution to the economy will be disappeared. Also, when they lose their income, it will be quite difficult to maintain their living conditions and the impact of unemployment on the economy and social life is enormous.

Unfortunately, data is not available at province level, we have data only at subregion level so we assume that unemployment rate of provinces is equal to subregions. We expect that there is a positive relationship between unemployment rate and electricity theft and loss ratio. Because, people would use more illegal electricity when their economic condition is bad. So, poor economic conditions could encourage people to use illegal electricity to provide their basic needs. Also, Saini (2016) concludes that an unemployed person in India do not prefer to spend money on electricity bills but they have to use the money for their daily needs rather than electricity. Therefore, there is a positive correlation between unemployment and electricity theft and loss ratio.

The fourth independent variable is population density which shows people per square km. When we look the Figure 3.1., population density of Turkey is increasing and this could cause electricity distribution companies not to control transmission lines and electricity meters. In addition to that, Saini (2016) mentions about the probability of electricity theft is higher in the populated areas and determining the illegal consumption which is done by hooking techniques and other illegal methods is very difficult. Because, there is a mesh of transmission lines in crowded areas and it is very hard to distinguish hook connection in lines. Therefore, we expect that population density will have positive impact on electricity theft and loss ratio in the model.

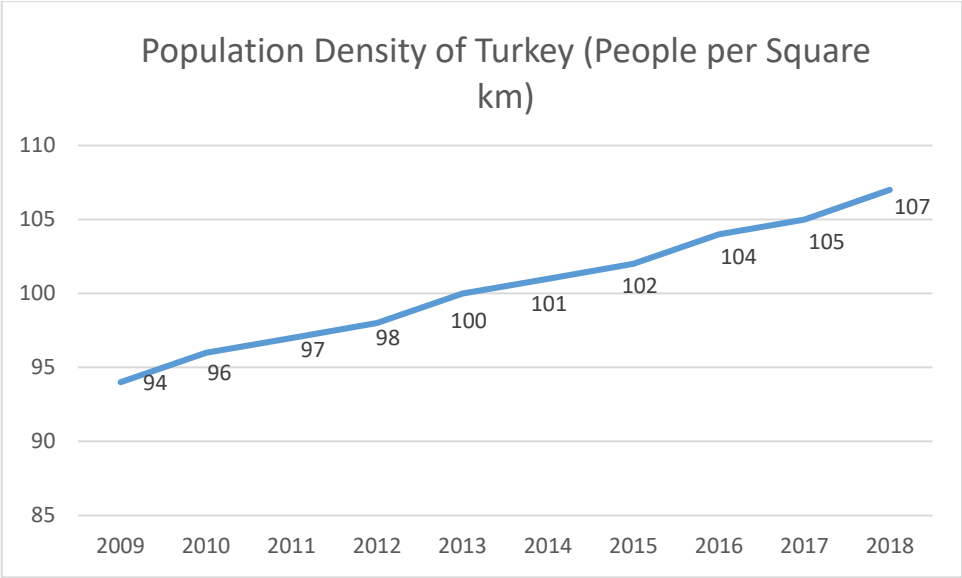

Figure 3.1. Population Density of Turkey (People per Square km)

Our variable of interest and our contribution in this paper, refugee rate. The rate which is calculated by dividing the number of refugees in the city by the population of the city. Refugee rate shows the percentage of refugees in the population on that province. Millions of Syrians immigrated to other countries after the civil war that started in Syria in March 2011. According to Republic of Turkey Ministry of Interior Directorate General of Migration Management, after the outbreak of Syrian civil war, Syrians have started to immigrate to Turkey in 2012 and number of Syrian Refugees in Turkey has increased every year. Figure 3.2. shows us the number of Syrian Refugees in Turkey.

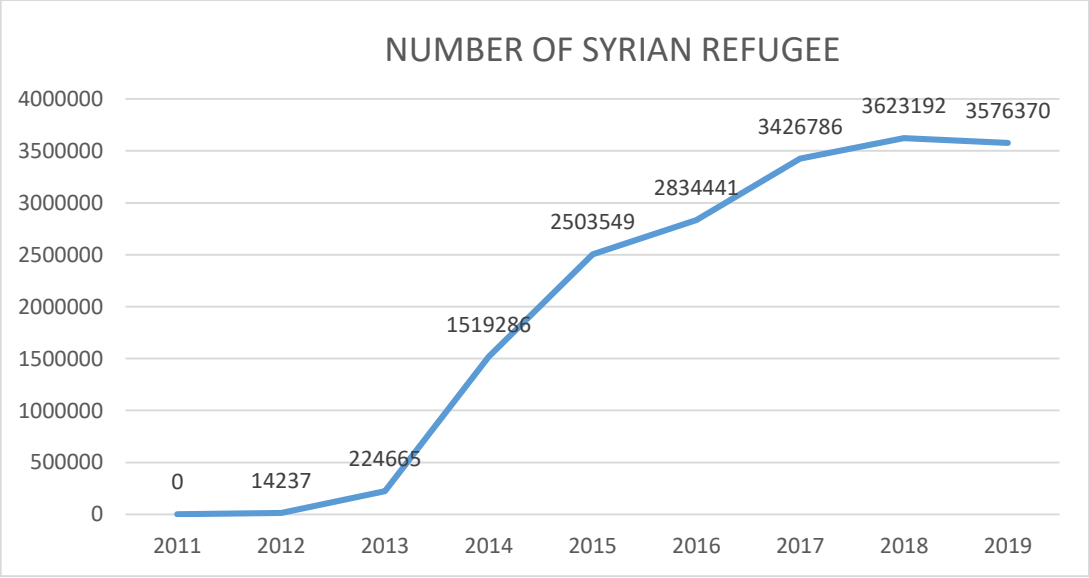

Figure 3.2. Number of Syrian Refugees in Turkey

It may be argued that country of origin where immigrants came from and illegal electricity consumption on that location might be important. If we check our special case of Syrian immigrants, World Bank data suggest that Syria has an average of 22. 71 percent electricity theft and loss ratio between 2000 and 2010. On the other hand, Turkey's has a relatively lower average of 15.90 percent electricity theft and loss ratio at the same period. This information could show us refugees on average might be more prone to consume illegal electricity than mainland's citizens in this special case. Of course, it is irrelevant to argue that refugees would always be engaged in electricity theft more than mainland's citizens. People's background, income, education levels and moral properties play a big role here.

Moreover, Toroslar Electricity Distribution Company applied to Energy Market Regulatory Authority (EMRA) in 2014 to revise their electricity theft and loss targets, which are determined by EMRA, due to immigrant influx which causes sudden population growth in the region which makes difficult to control the illegal electricity consumption. Also, electricity consumption is measured in camps which were created for immigrants and bills are paid regularly. However, company stated that some of the immigrants living outside the camps use illegal electricity, there are problems in their subscription transactions, and therefore, illegal consumption and technical losses have increased in company's provinces. The company requested a one percent revision for their target in his applications to EMRA but, EMRA made correction below one percent. In 2014, Toroslar Elecetricity Distribution Company distributed approximately 14,8 TWH electricity and value one percentage of this amount is around 148 GWH and it costs around 70 million TL. Therefore, this amount contributed to refugees and this allowed migrants to meet their daily needs.

In terms of immigrants and its impact on Turkish economy rather than energy, Ceritoğlu (2015) and Tümen (2016) analyze the effect of Syrian Refugees on labor market and they find many impacts on native labor market. When they immigrated to Turkey, they had not work permission and they had poor economic conditions which caused a lot of difficulties for them and they struggled to survive. So, refugees could affect many sectors to meet their daily needs and illegal electricity consumption could

be one of them. Because of all reasons, we will add refugee variables in my model and try to understand the relationship between electricity theft and loss ratio.

Another independent variable is the amount of agricultural land where there is an electricity consumption to irrigate the agricultural area. The more agricultural land, the more electricity consumption for agriproducts will be. Under the case that the rains are insufficient, farmers irrigate their fields with ground waters that they draw from underground with electric motors and this could increase the electricity consumption in agricultural irrigation. The amount of electricity used for agricultural irrigation in Turkey is approximately 8.5 terawatt in 2018 and this amount was approximately 3.5 terawatt in 2009. The amount of electricity used for agricultural irrigation is increasing every year in Turkey and this consumption is very high cost for farmers so it has become very important to control electricity theft and loss in this sector. Also, the use of illegal electricity methods in agricultural irrigation harms the electrical quality, service quality and continuity of energy supply. Moreover, Golden and Min (2012) conclude that there is a positive relation between agricultural activities and electricity theft and loss for Indian. Therefore, we expect that there is a positive relation between amount of agricultural land and electricity theft and loss.

The last independent variable is that we will use in my panel data estimations is the privatization. Electricity distribution companies in Turkey, were privatized within the frame of the European Union harmonization process and the process was completed in 2013. There were some key benefits expected from privatizations like: efficient operation of electricity generation and distribution, reducing costs, ensuring electrical energy supply security and increasing supply quality, reducing technical losses in the distribution sector to the averages of OECD countries and preventing electricity theft, ensuring that the necessary renewal and expansion investments can be made by the private sector without imposing a burden on the public sector, and competition with electricity distribution companies provide service quality to consumers. Also, distribution companies have a target about electricity theft and loss ratio which is determined by Republic of Turkey Energy Market Regulatory Authority. Therefore, distribution companies try to decrease illegal electricity use in their region to avoid losing money. In addition to that, Andres, Foster and Guasch (2006) find that

privatization leads to significantly increase labor productivity, efficiency, and service quality in electricity distribution system. Moreover, average of theft and loss ratio of Turkey is decreasing each year after the privatization process of electricity distribution.

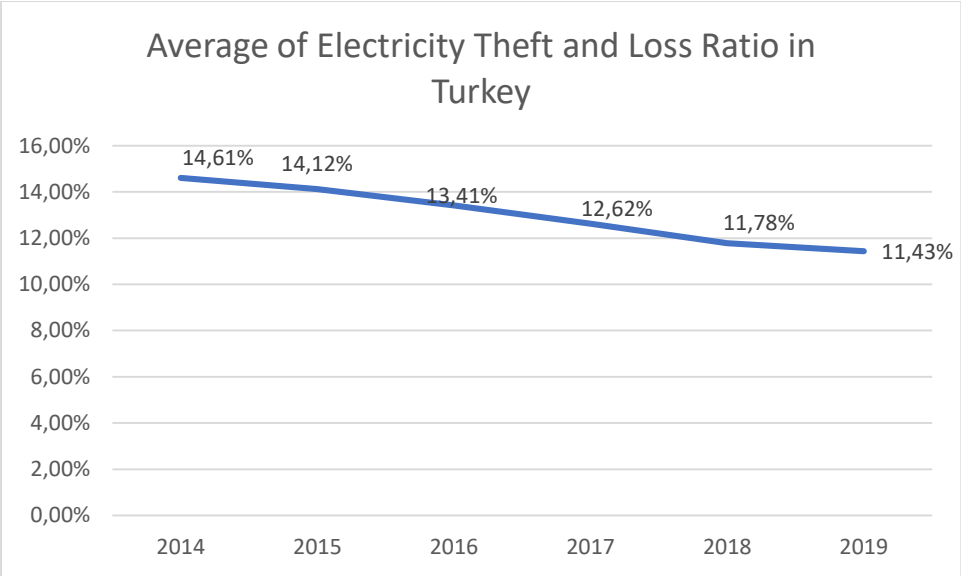

Figure 3.3. Average of Electricity Theft and Loss Ratio in Turkey

Figure 3.3. shows us, there is a declining trend in average of electricity theft and loss ratio in Turkey after the privatization process. Also, Figure 3.4. shows us average of electricity theft and loss ratio in the World and OECD countries and average of electricity theft and loss ratio in Turkey is still very high and understanding reason of the theft and loss is very important.

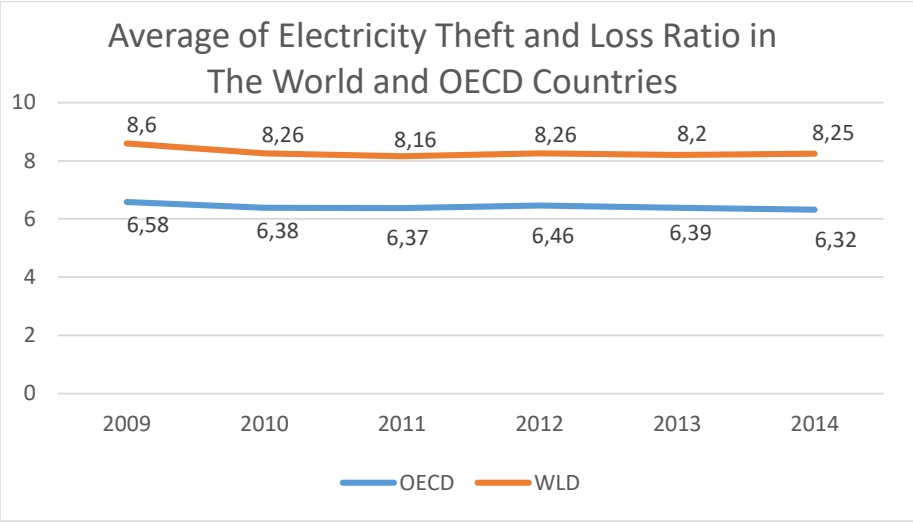

Figure 3.4. Average of Electricity Theft and Loss Ratio in The World and OECD Countries

To analyze the effect of privatization, we will add a dummy variable to check whether private sector control the distribution of electricity of the city. If private sector controls the distribution of electricity, dummy variable will equal to one for that year, otherwise it will be zero. Therefore, we expect that there is a negative relation between privatization and electricity theft and loss.

CHAPTER 4

MODEL AND ESTIMATION RESULTS

4.1. Panel Data Model

We will use panel data for regression analysis because it gives an opportunity to analyze both time and cross section dimensions and these dimensions provide extra information for the analysis. Therefore, panel data method is the suitable one to interpret and analysis the data. Also, data for both province and time dimension is complete for 27 cities. The variables, their explanation, years for which they are available and their sources are listed below:

TLR: Theft-Loss Ratio
SRR: Refugee Rate
GDP (Turkish Lira): Gross Domestic Product of Provinces
UNMR : Unemployment Rate
PRVT: Privatization
AGR: Agricultural Land Amount
PD: Population Density
ER: Education Ratio

4.1.1. Empirical Results

The fixed effect method will be applied in the model and you can see the test for the validity of the fixed effect method in the next sections. The Fixed effect model uses the ordinary least square principle and assumptions of the ordinary least square method is valid for this method. The fixed effect model produces a constant intercept for each cross section and control for, or partial out, the effects of time-invariant variables with time-invariant effects. Also, it provides to control for cross-sectional heterogeneity effectively through dummy variables for each province.

The regression is:

$$TLR_{it}=C_{it}+\beta_1 UNMR_{it}+ \beta_2 ER_{it} +\beta_3 Log(GDP_{it}) + \beta_4 PD_{it} + \beta_5 SRR_{it} + \beta_6 Log(AGR_{it}) +\beta_7 PRV_{tit} + \varepsilon_{it}$$

Table 4.1. shows result of the fixed effect panel data regression for illegal electricity consumption.

Table 4.1. Result of Fixed Effect Panel Data Regression

Dependent Variable: Theft and Loss Ratio				
Variable	Coefficient	Standard error	t-Statistic	Prob
SRR	0.07**	0.03	2.46	0.02
GDP	0.08	0.06	1.39	0.17
UNMR	0.16**	0.08	1.96	0.05
PRVT[a]	-0.03***	0.01	-2.90	0.00
AGR	-0.04*	0.02	-1.67	0.10
PD	0.2***	0.07	3.23	0.00
ER	-0.01	0.16	-0.08	0.93

* Significant at 10%
** Significant at 5%
*** Significant at 1%
a Dummy Variable

When we look the Table 4.1. above, probabilities of Refuge Rate, Unemployment Rate, Population Density, Amount of Agricultural Land and Privatization are significant independent variables in the model. On the other hand, probabilities of GDP and Education Rate are insignificant independent variables in the model.

Another important indicator is the sign of the variables. While privatization, education rate and amount of agricultural land have an impact on preventing illegal electricity use, refugee rate, unemployment rate, GDP and population density have an effect to

increase the illegal electricity consumption. Signs of refugee rate, Unemployment Rate, Population Density, Education Rate and Privatization are parallel with literature, but signs of amount of agricultural land and GDP are contradictory with literature. On the other hand, GDP, and education level are insignificant independent variables in the model.

Panel data analysis fixed effect estimations have some assumptions and we have to be sure these assumptions are valid. You can see tests for the assumption in the next section.

4.1.2. Assumption Tests

Fixed effect panel data models need to provide some assumptions to prove that they are valid in our model. If one or more of the assumptions aren't satisfied in the model, the results lost their reliability. Therefore, it should be tested whether there is any deviation from the assumptions.

Fixed effects panel method assumed that subjects are independent to each other and this method tries to examine the relationship between dependent variable and independent variables within an entity. Each entity, province in our model, has its own individual characteristics which could or could not affect the predictor variables.

4.1.2.1. Fixed Effect Tests

Firstly, we will provide a test on whether the fixed effect model or the random effect model is suitable for the panel set. We will use Hausman test to decide the model.

You can see the Hausman test result in the Table 4.2. for cross-section random effects.

H_0: Random effects are independent of explanatory variables
H_1: H_0 is not true.

Table 4.2. Result of Housman Test for Cross-Section Random Effects

Test Cross-Section Random Effects			
Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	169.73	7	0.0000

We can reject the null hypothesis because the p-value is small (less than 0.05) and so fixed effect model will be used in the model for cross-sections.

According to Hausman test, we will apply fixed effects model for cross section and time period. Using fixed-effects will show us the impact of variables that vary over time. Also, fixed effect method examines the relationship between independent variables and dependent variables within a province in our model.

4.1.2.2. Heteroscedasticity Test

In this section, validity of constant variance assumption will be tested in regression. Heteroskedasticity problem occurs when the standard errors of a variable are non-constant. Heteroscedasticity is the important problem in the regression analysis because ordinary least squares regression assumes that all residuals have a constant variance. Therefore, we have to check the residuals' variance to obtain reliable results. It will be tested with the modified Wald test which is used for the fixed effect panel data models to control heteroscedasticity problem by establishing a null hypothesis based on constant variance.

The modified Wald test statistic is calculated as follows (Greene, 2002, s. 488):

$Vi = Ti\text{-}1\ (Ti - 1) \sum_{t=1}^{T_i} (e_{it}^2 - \alpha_i^2)^2$

$W = \sum_{i=1}^{N} \frac{(\alpha_i^2 - \alpha^2)}{V_i}$

H_0: Constant variance assumption is valid

H_1: H_0 is not true.

chi2 (27) = 1284.08

Prob>chi2 = 0.0000

Probability is lower than 0,05 so we reject the null hypothesis and we can say that there is a heteroscedasticity problem in the model. So, the standard errors of a variable are non-constant and ordinary least squares regression assumption is violated. We have to get rid of heteroscedasticity problem in the model to obtain reliable results and we will use Robust Standard Errors Method to get rid of this problem in part 4.2.2.

4.1.2.3. Autocorrelation Test

Another assumption is that there is no autocorrelation in the model. Autocorrelation means that the degree of correlation between the values of variables across different observations in the data. We can usually see this situation for time series data because observations occur at different points in time. To test this assumption, we will apply The Durbin-Watson test. This test could use for fixed effect pane data regression.

$$d = \frac{\sum_{i=1}^{N}\sum_{t=2}^{T}[e_{it} - e_{i,t-1}]^2}{\sum_{i=1}^{N}\sum_{t=2}^{T} e_{it}{}^2}$$

H_0: There is no autocorrelation

H_1: H_0 is not true.

Durbin Watson Stat =1,91

One of the important assumptions in regression is that the error terms are independent of each other. If Durbin–Watson statistic is less than 2, we have to suspect positive serial correlation. But, if Durbin -Watson stat is less than 2 and higher than upper bound value, we can say that there is no autocorrelation problem in our model. When we look the Durbin Watson test statistic, it is higher than upper bound value which is 1.765 and less than 2. Therefore; we can accept the null hypothesis and there is no

autocorrelation problem in the model and the error terms are independent of each other.

4.1.2.4. Cross Independence Test

Another assumption to be tested for the validity of the fixed effect model is the cross sections' independency. There are many methods to test cross section independency. These are Pesaran CD test , Friedman test, Frees Q test. We will use Pesaran CD test for the regression. The reason for this test is that the number of units of this test is greater than the time period (N >T). Also, Baltagi (2005) suggests Pesaran CD Test for cross-section dependence in case of N > T.

Pesaran test statistic is calculated as follow and δ is the cross-section relation coefficient. (Pesaran M. H.,2004, p. 5)

$$CD = \sqrt{\frac{2T}{N(N-1}} \left[\sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \delta ij\right]$$

In the Table 4.3., you can find Pesaran CD test hypothesis, test statistics and probability value of test statistics.

Table 4.3. Result of Paseran CD Test

H_0 : There is no cross- section dependency	
Test Statistic	Prob.
0.457	0.647

The probability value of the calculated test statistic is 0.457 and probability is 0.647 which is greater than 0.05. Therefore; We cannot reject the null hypothesis and there is no cross-section dependency and the assumption that there is no cross-section dependency has been provided in the model.

To sum up, there is an only heteroscedasticity problem in the model. In this case, the results obtained from model is not reliable. Therefore; robust standard errors method will be applied in the next section.

4.1.3. Robust Standard Errors Methods

Heteroskedasticity causes standard errors to be biased and the results obtained from model is not reliable in fixed effect panel data method. When there is a heteroskedasticity in the model, robust standard errors tend to be more accurate. This method also known as Huber/White or sandwich estimators.

In the Table 4.4., you can see coefficients, standard errors and test statistics that are resistant to heteroskedasticity problem.

Table 4.4. Result of Robust Standard Errors Method

Dependent Variable: Theft and Loss Ratio				
Variable	Coefficient	Robust Std. Errors	t-Statistic	Prob
SRR	0.07**	0.03	2.09	0.05
GDP	0.08	0.06	1.22	0.23
UNMR	0.16*	0.08	1.92	0.07
PRVT[a]	-0.03***	0.01	-3.75	0.00
AGR	-0.04*	0.02	-2.13	0.04
PD	0.2***	0.06	3.72	0.00
ER	-0.01	0.11	-0.13	0.90

Robust standard errors are used
* Significant at 10%
** Significant at 5%
*** Significant at 1%
a Dummy Variable

When we look the results, coefficients do not change but standard errors and t test statistics changed. Refuge Rate, Unemployment Rate, Privatization, Population Density and Amount of Agricultural Land are significant independent variables in the model. On the other hands, GDP and ratio of graduation from at least primary school are insignificant independent variables in the model.

4.1.4. Summary and Inference

Refugee Rate, Unemployment Rate, Privatization, Population Density and Amount of Agricultural Land are significant independent variables in the model. We will analyze these variables in this part.

When we look the results there is a positive relation between Theft and Loss Ratio and Refugee Rate. Millions of Syria immigrated to other countries after the civil war that started in Syria and Turkey is the one of the host countries. We can say that refuge rates in the provinces increases by 1%, province's electricity theft and loss ratio also increases by 0.07%. Now, we will examine some provinces which have higher Refuge rate.

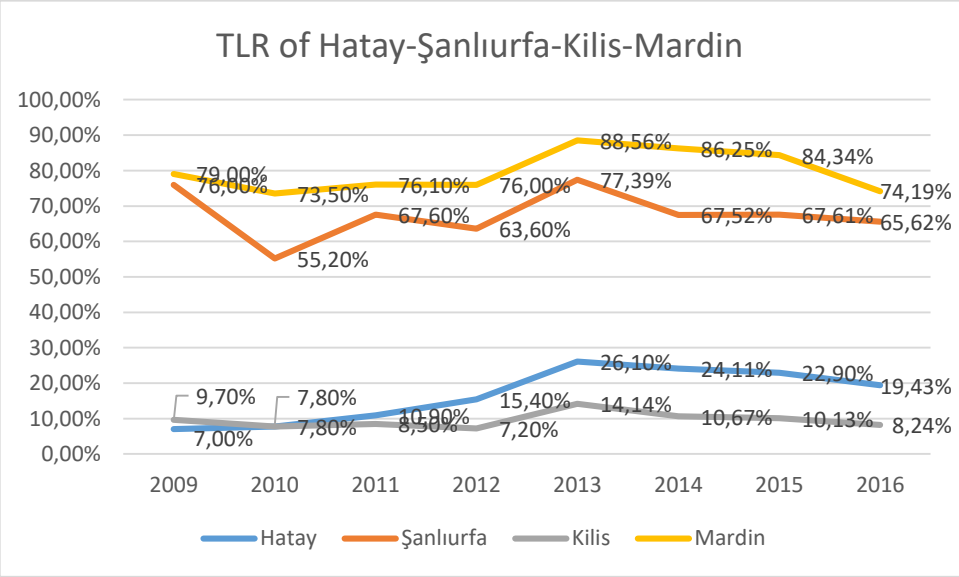

Figure 4.1. TLR of Hatay-Şanlıurfa-Kilis-Mardin

Figure 4.1. shows us change in TLRs of Şanlıurfa, Hatay, Kilis and Mardin. These provinces have higher refugee rate. After Syrian civil war started, many refugees immigrated to these cities. In 2012, these cities had almost 0% refugee rate but, in 2013 Şanlıurfa had 9.40% , Hatay had 12.60%, Kilis had 38.10% and Mardin had 9.00% refugee rate.

In Figure 4.1., we can see that Şanlıurfa's TLR increased by 13,79%, Hatay's TLR increased by 10.70% , Kilis's TLR increased by 8,94% in 2013 and Mardin's TLR increased by 12,56% in 2013. We can say that refugees could be the reason of these increasing in TLR. Because, Ceritoğlu et al.(2015) and Tümen (2016) concludes that the refugees did not have a formal work permit, they supplied inexpensive informal unskilled labor so they have poor economic condition which could make them to use illegal electricity. Also, theft reports were not accrued due to the absence of identity documents for refugees and this illegal electricity consumption is involved in theft and loss ratio. Moreover, the immigration causes sudden population growth and electricity distribution companies hadn't enough sources to struggle with this sudden population growth and this could increase the theft and loss ratio. On the other hand, we can see that TLR is tend to decrease after 2013 in the figure. One of the reasons could be effect of the privatization. Another reason could be that distribution companies could learn how to deal with refugees.

Another significant variable is unemployment rate. There is a positive relation between TLR and Unemployment Rate. We can say that unemployment rate in the provinces increases by 1%, electricity theft and loss ratio also increases by 0.16%. So, this implies that joblessness also has an effect on TLR. Higher unemployment shows that there are fewer employment opportunities available and thus the opportunity cost of choosing crime over legitimate work is low. Because, if people do not have job, this leads to poor economic conditions for people and paying electricity bills will be harder. Also, electricity is crucial to maintain people's life so joblessness will encourage

people to use illegal electricity. Therefore, there is positive relation between TLR and UNMR.

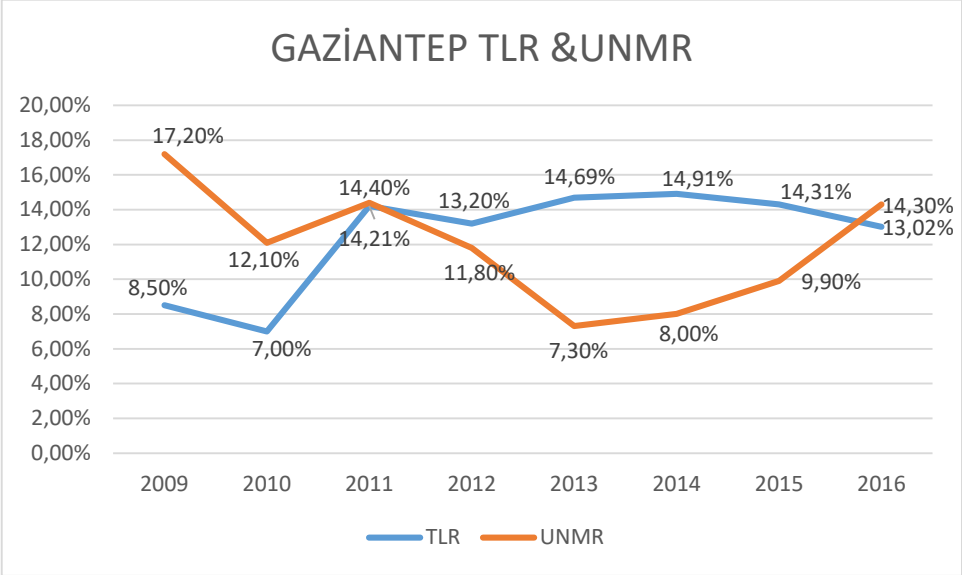

Figure 4.2. TLR & UNMR of Gaziantep

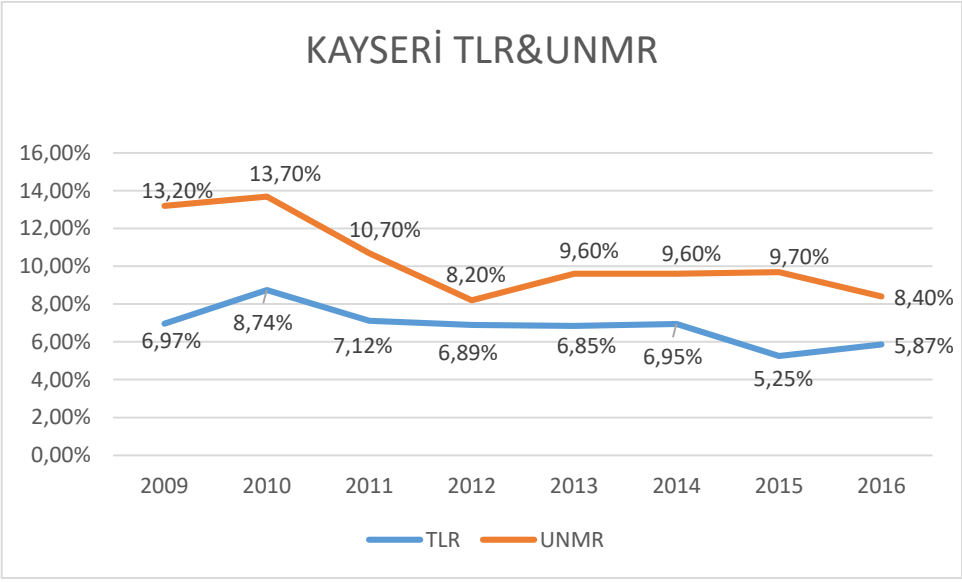

Figure 4.3. TLR & UNMR of Kayseri

When we look the Figure 4.2. and 4.3., TLR and UNMR moves together for Kayseri and Gaziantep in the period of the 2009 to 2012. In this period, there is no privatization and refugees' effect for these cities and change in population density is very small so

this period could give us correct information about relation between TLR and UNMR. TLR and UNMR decreases together in 2010 and 2012, and increases in 2011 for Gaziantep. Also, TLR and UNMR increases together in 2010, and decreases in 2011 and 2012 for Kayseri.

Privatization is another significant variable in the model. According to result, there is a negative relation between TLR and PRVT. If private sector controls the distribution of electricity, theft and loss ratio decreases by 3% for every year. After privatization, distribution companies have targets about theft and loss ratio which are determined by EMRA and they earn extra money if they reach the targets. Therefore, distribution companies try to decrease theft and loss ratio for every year and they make an effort to enhance their system to avoid illegal electricity using.

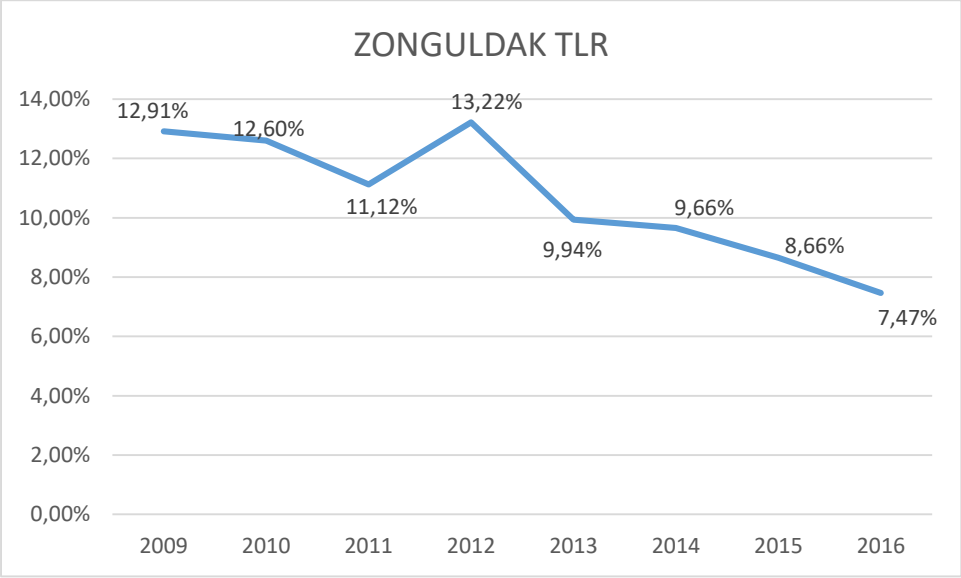

Figure 4.4. TLR of Zonguldak

Privatization of Zonguldak started in 2009 and private sector totally has controlled the electricity distribution of this province since 2010. When we look the Figure 4.4., TLR of Zonguldak in 2009 is 12.91% and after privatization, TLR decreased to 7.47% in 2016.

Privatization of Şanlıurfa started in 2013 and private sector totally has controlled the electricity distribution of this province since 2014. When we look the Figure 4.1., TLR of Şanlıurfa in 2013 is 77.39% and after privatization, TLR decreased to 65.62% in 2016.

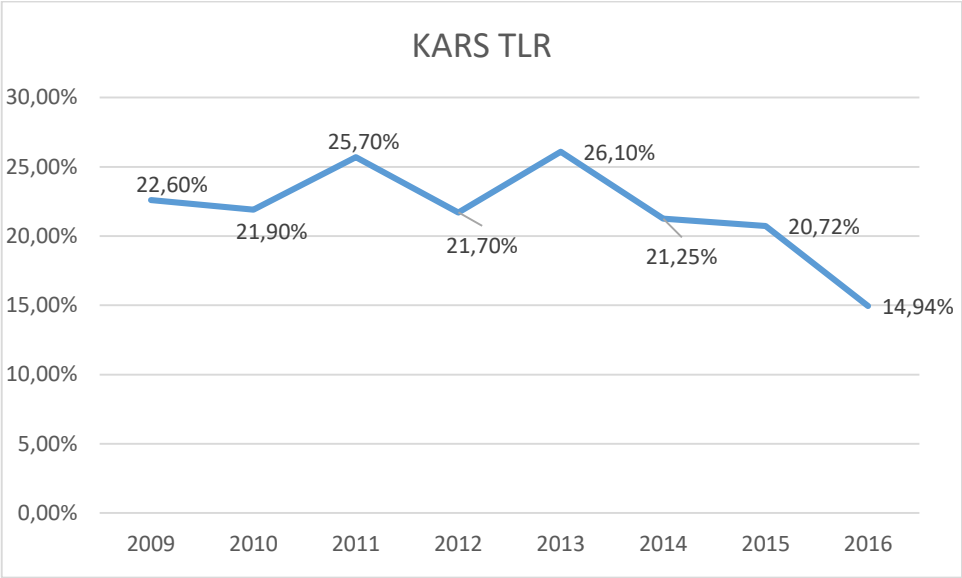

Figure 4.5. TLR of Kars

Privatization of Kars started in 2013 and private sector totally has controlled the electricity distribution of this province since 2014. When we look the Figure 4.5., TLR of Kars in 2013 is 26.10% and after privatization, TLR decreased to 14.94% in 2016.

Results show us, Population Density is significant variable and there is a positive relation between TLR and PD. We can say that number of people per square km increases by 1, electricity theft and loss ratio of provinces also increase by 0.002%. This result is parallel with literature. Because, there is a mesh of transmission lines in crowded areas and it is very hard to distinguish hook connection in lines.

Another significant factor is amount of agricultural land and it has a negative effect on electricity theft and loss ratio. This result is not parallel with literature. Because, registration of agricultural lands have been increasing in recent years and distribution companies could have information about agricultural lands and could take precautions about agricultural land. Electricity distribution companies increase the controls of agricultural land so there is a negative relation between TLR and AGR.

According to literature, we expected that GDP and ratio of graduation from at least primary school are significant independent variables. But these factors are insignificant in our model and we try to explain the reason of that.

According to literature, GDP is one of the major factors about using illegal electricity however, in our model, it is insignificant. Income distributions of provinces may be unbalanced and amount of people which have poor economic condition, may not be reflected in this variable so GDP could be insignificant in the model. Also, education level is insignificant for 27 provinces. In these provinces, we could not see the effect of education level on electricity theft and this situation could be a specific case for them.

4.2. DID Estimation

In this part, we will apply a difference-in-differences (DID) estimation in my model. DID is a natural experiment method which uses treatment and control groups to evaluate the effect of the event or policy. In this method, we can observe a sample of units before the treatment and after that we observe the same unit after the policy has occurred. So, control group is not affected by the policy and treatment group is affected by the policy in this model.

After the outbreak of civil war in 2011, refugees started to immigrate to Turkey in 2012 and The Turkey has established refugee camps near the Southeastern border to accommodate the refugees. Therefore, especially the border provinces have larger

numbers of refugees than other provinces. This situation gives us an opportunity to apply DID estimation and we will try to explore the effect of this immigration policy on electricity theft in our model.

Table 4.5 shows the provinces' refugee rate between 2013 to 2016 and every year refugee rates of provinces are usually increased and the refugee inflows were much more intensive.

Table. 4.5 Refugee Rate of Provinces

PROVINCES	**2013**	**2014**	**2015**	**2016**
ADANA	2,30%	4,18%	6,21%	6,83%
ANKARA	0,00%	0,00%	0,98%	1,19%
ARTVİN	0,00%	0,00%	0,02%	0,02%
BARTIN	0,00%	0,00%	0,01%	0,01%
BAYBURT	0,00%	0,00%	0,03%	0,04%
DİYARBAKIR	0,00%	0,48%	1,68%	1,74%
ERZİNCAN	0,00%	0,00%	0,07%	0,08%
GAZİANTEP	6,65%	17,27%	16,87%	16,49%
GÜMÜŞHANE	0,00%	0,00%	0,04%	0,04%
GİRESUN	0,00%	0,00%	0,02%	0,03%
HATAY	12,60%	13,03%	23,73%	24,65%
KARABÜK	0,00%	0,00%	0,10%	0,13%
KARS	0,00%	0,00%	0,04%	0,05%
KASTAMONU	0,00%	0,00%	0,14%	0,18%
KAYSERİ	0,00%	1,50%	3,05%	3,93%
KIRIKKALE	0,00%	0,00%	0,13%	0,24%
KİLİS	38,10%	75,73%	95,13%	94,05%
MARDİN	9,00%	8,52%	11,70%	11,68%
MERSİN	2,60%	3,78%	7,29%	7,77%
OSMANİYE	2,40%	4,51%	7,21%	7,82%
RİZE	0,00%	0,00%	0,13%	0,18%
TRABZON	0,00%	0,00%	0,17%	0,25%
ZONGULDAK	0,00%	0,00%	0,04%	0,05%
ÇANKIRI	0,00%	0,00%	0,09%	0,16%
ŞANLIURFA	9,40%	23,14%	20,01%	21,02%
ŞIRNAK	4,00%	8,03%	2,55%	2,93%
SİİRT	0,00%	0,00%	0,84%	0,96%

Econometric specification:

In this model, we construct a two-dummy variable: S taking 1 in the treatment group, 0 in the control group and another dummy variable T taking 1 in the after-immigration period, 0 in the before immigration period. We mainly follow Ceritoglu (2015) and our DID equation is formulated as follows:

$$TLR_{it}=Cit+\lambda_1 UNMR_{it}+ \lambda_2 ER_{it} +\lambda_3 Log(GDP_{it})+ \lambda_4 PD_{it} + + \lambda_5 Log(AGR_{it}) +\lambda_6 PRVt_{it} + \lambda_7 S_i +\lambda_8 T_i+ \lambda_9 (S_i \text{ x } T_i)+\varepsilon_{ij}$$

Also, we can express the model by removing S and T, and adding a cross section and year fixed effects denoted by kj and kt , respectively. So our equation will be follows:

$$TLR_{it}=C_{it}+\lambda_1 UNMR_{it}+ \lambda_2 ER_{it} +\lambda_3 Log(GDP_{it})+ \lambda 4 PD_{it} + + \lambda_5 Log(AGR_{it})+\lambda_6 PRVt_{it} + \lambda_9 (S_i \text{ x } T_i)+k_j+k_t+\varepsilon_{it}$$

This equation is suitable with the structure of the standard DID estimation and Carpenter (2004) and Wooldridge (2010) used this structure. We will use fixed effect specification in our regressions because coefficients of S and T is not our interest.

4.2.1. Result and Inferences

In this part, we show the estimated effect of the refugee inflow on electricity theft and loss ratio in provinces which have higher refugee rate. Firstly, we label the provinces which have at least 1% refugee rate in one of year, as the “treatment area,” we label provinces which have average near to 0 % refugee rate, as the “control area.”. The treatment provinces are Kilis, Osmaniye, Gaziantep, Şanlıurfa, Şırnak, Adana,Kayseri Mardin, Hatay, Mersin, Diyarbakır, Siirt and Ankara. These province have higher

refugee rate for example; Kilis has 94% , Hatay has 24% ,Şanlıurfa has 21% and Gaziantep has 16% refugee rate in 2016. On the other hand, Artvin, Bartın, Bayburt, Erzincan, Gümüşhane ,Giresun, Karabük, Kars, Kastamonu, Kırıkkale, Rize, Trabzon, Zonguldak, and Çankırı are our control group and they have lower refugee rate. When we look the treatment and control group provinces, their electricity distribution companies have same aim and they try to decrease their electricity theft and loss ratio to increase their profit. Also, the average of electricity theft and loss ratios of treatment group, which is around 31 percent in 2009, is almost the same in 2012. This situation is similar for control group. The average of electricity theft and loss ratios of control group, which is around 10 percent in 2009, is almost the same in 2012.Therefore, we can say that treatment and control group have same trend before the treatment.

We set 2009-2011 as the pre-immigration and 2012-2016 as the post-immigration period. We add province and year fixed effect our model and Table 4.6 shows us the effect of the refugee inflows on electricity theft and loss ratio. The first variable, our DID estimator, shows that the refugee inflow to the treatment areas in Turkey increases the electricity theft and loss ratio by 2 percentage points for treatment group provinces compared to the control group provinces.

Table 4.6 DID Regression Result for Post-Immigration 2012-2016 and At Least 1% Refugee Rate

Dependent Variable: Theft and Loss Ratio				
Variable	Coefficient	Robust Std. Errors	t-Statistic	Prob
REFUGEE EFFECT(S X T)	0.02*	0.01	1.88	0.07
GDP	0.07	0.07	1.10	0.28
UNMR	0.11	0.09	1.19	0.25
PRVT[a]	-0.02***	0.01	-3.05	0.01
AGR	-0.03**	0.02	-2.22	0.04
PD	0.20***	0.05	3.40	0.00
ER	-0.02	0.11	-0.17	0.87
CONSTANT	-1.16	1.41	-0.82	0.41

Robust standard errors are used
* Significant at 10%
** Significant at 5%
*** Significant at 1%
a Dummy Variable

If we set 2009-2012 as the pre-immigration and 2013-2016 as the post-immigration period and Table 4.7 shows that the refugee inflow to the treatment areas increases the electricity theft and loss ratio by 3.2 percentage points for treatment group provinces compared to the control group provinces.

Table 4.7 DID Regression Result for Post-Immigration 2013-2016 and At Least 1% Refugee Rate

Dependent Variable: Theft and Loss Ratio				
Variable	Coefficient	Robust Std. Errors	t-Statistic	Prob
REFUGEE EFFECT(S X T)	0.03**	0.01	2.53	0.02
GDP	0.07	0.07	1.13	0.27
UNMR	0.08	0.09	0.85	0.40
PRVT[a]	-0.03***	0.01	-3.77	0.00
AGR	-0.04**	0.02	-2.37	0.03
PD	0.13**	0.05	2.42	0.02
ER	-0.01	0.11	-0.01	0.99
CONSTANT	-1.02	1.29	-0.79	0.44

Robust standard errors are used
* Significant at 10%
** Significant at 5%
*** Significant at 1%
a Dummy Variable

Now, we label the provinces which have at least around 2% refugee rate in one of year, as the "treatment area," we label provinces which have near to 0 % refugee rate, as the "control area.". So, we drop Ankara, Diyarbakır and Siirt in our Treatment

group. We set 2009-2011 as the pre-immigration and 2012-2016 as the post-immigration period and Table 4.8 shows that the refugee inflow to the treatment areas increases the electricity theft and loss ratio by 2.2 percentage points for treatment group provinces compared to the control group provinces.

Table 4.8 DID Regression Result for Post-Immigration 2012-2016 and At Least 2% Refugee Rate

Dependent Variable: Theft and Loss Ratio				
Variable	Coefficient	Robust Std. Errors	t-Statistic	Prob
REFUGEE EFFECT(S X T)	0.02*	0.01	1.81	0.08
GDP	0.05	0.06	0.76	0.46
UNMR	0.18	0.12	1.52	0.14
PRVT[a]	-0.03***	0.01	-3.40	0.00
AGR	-0.02*	0.01	-1.74	0.10
PD	0.20***	0.06	3.69	0.00
ER	-0.03	0.11	-0.22	0.83
CONSTANT	-0.83	1.34	-0.62	0.54

Robust standard errors are used
* Significant at 10%
** Significant at 5%
*** Significant at 1%
a Dummy Variable

After that, we set 2013 as the post-immigration period in table 4.9. The refugee amount is much more in 2013 than 2012 and we have larger coefficients when we set 2013 as the post-treatment period compare to 2012 as the post-treatment period. Our DID estimator, shows that the refugee inflow to the treatment areas in Turkey increases the electricity theft and loss ratio by 3.5 percentage points for treatment group provinces compared to the control group provinces.

Table 4.9 DID Regression Result for Post-Immigration 2013-2016 and At Least 2% Refugee Rate

Dependent Variable: Theft and Loss Ratio				
Variable	Coefficient	Robust Std. Errors	t-Statistic	Prob
REFUGEE EFFECT(S X T)	0.04**	0.02	2.35	0.03
GDP	0.04	0.06	0.78	0.44
UNMR	0.16	0.11	1.44	0.16
PRVT[a]	-0.03***	0.01	-4.27	0.00
AGR	-0.02*	0.01	-1.88	0.07
PD	0.16***	0.05	3.27	0.00
ER	-0.01	0.12	-0.09	0.93
CONSTANT	-0.69	1.19	-0.58	0.57

Robust standard errors are used
* Significant at 10%
** Significant at 5%
*** Significant at 1%
a Dummy Variable

To sum up, all possible scenarios of DID estimators show us refugee immigration has significantly positive effect on electricity theft and loss ratio in Turkey. Especially, when we apply post-immigration period for 2013-2016, coefficients of DID estimators are higher and effect of influx is one of the essential problems for Turkish electricity market.

CHAPTER 5

CONCLUSION

In this thesis, we develop an economic model to understand whether immigration resulted in a significant effect in electricity sector, namely electricity theft. We are using the special case of Syrian immigration influx in Turkey to find this relationship. Electricity theft is a crucial problem for electricity distribution companies and government. For example, average of electricity theft and loss ratios of distribution companies in Turkey is %13.41 in 2016. The amount of loss because of electricity theft was very high and the consumers, who pays their bills regularly, take the burden of this loss. This has negative effect on social justice and the investment decisions at the regional level so decreasing of electricity theft is major concern of countries and understanding of the socio-economic background of using illegal electricity will help us to prevent this behavior.

Our findings suggest that after the immigration influx the electricity theft increased significantly both using panel data and difference in differences estimations. Panel data results shows us refuge rates in the provinces increases by 1%, province's electricity theft and loss ratio also increases by 0.07%. In DID estimation, when we label the provinces which have at least around 2% refugee rate in one of year, as the treatment group, and we set 2013-2016 as the post-immigration period, result shows that the refugee inflow to the treatment group increases the electricity theft and loss ratio by 3.5 percentage points for treatment group provinces compared to the control group provinces.

The other variables that significantly impact the illegal electricity consumption in are unemployment rate, privatization, population density and amount of agricultural land. While privatization and amount of agricultural land have a significant impact on

preventing illegal electricity use, Unemployment rate and population density have an effect to increase the illegal electricity consumption. On the other hand, GDP and education level are insignificant independent variables in the model. So, government and companies should take into consideration these factors to determine their strategy about preventing electricity theft.

As the main contribution of this thesis is that immigrants need to use electricity to fulfil their daily needs and it affects electricity theft and loss ratio due to harsh conditions of refugees and sudden population growth which makes difficult to control illegal electricity consumption. It is quite obvious that the immigration influxes might have been quite difficult not only from the perspective of immigrated countries but from the perspective of immigrants themselves. Although it seems humanly to let immigrants use the electricity for free and might help them financially, it might result in honest citizens to pay for this loss. Perception in the mainland in terms of electricity theft might also be deprived, and all of the citizens might be engaged in this form of illegal consumption more. In this context, it would be appropriate to help immigrants with other financial aids and provide better economic conditions for them in the mainland. Some form of aids both for natives and immigrants that can help them get rid of energy poverty might be seen as a better solution for countries especially developing countries like Turkey.

REFERENCES

AFAD (2013): “Syrian Refugees in Turkey, 2013: Field Survey Results,” Turkish Disaster and Emergency Management Presidency.

Aksu, E. , Erzan, R. and Kirdar, M.G. (2018): "The Impact of Mass Migration of Syrians on the Turkish Labor Market," Koç University-TUSIAD Economic Research Forum Working Papers 1815, Koc University-TUSIAD Economic Research Forum.

Baltagi, B. H. (2005): “Econometric analysis of panel data”, 3rd ed., John Wiley and Sons Ltd.

Andres,L.A. , Guasch, J. L., and Foster,V. (2006) : “The Impact of Privatization on the Performance of the Infrastructure Sector: The Case of Electricity Distribution in Latin American Countries.” Policy Research Working Paper No. 3936, Washington, D.C.: World Bank

Bhattacharyya, S. (2005): “The Electricity Act 2003: will it transform the Indian power sector? ” Util. Policy 13 (3), 260-272

Birdsall, N., and Nellis, J.(2003) : “Winners and Losers: Assessing the Distributional Impact of Privatization,” World Development, Elsevier, vol. 31(10), pages 1617-1633, October.

Carpenter, C. (2004): “How Do Zero Tolerance Drunk Driving Laws Work?” Journal of Health Economics, 23, 61–83.

Cengiz, D. and Tekgüç H. (2018) : “Is It Merely A Labor Supply Shock? Impacts of Syrian Migrants on Local Economies in Turkey”. Mimeo.

Ceritoglu, E., H. B. Gurcihan Yunculer, H. Torun, and S. Tumen (2015): “The Impact of Syrian Refugees on Natives’ Labor Market Outcomes in Turkey: Evidence from a Quasi-Experimental Design,” Unpublished manuscript, Central Bank of the Republic of Turkey

Çoruh Electricity Distribution Company (2013): "2013 Annual Report" Available from: https://www.coruhedas.com.tr/BilgiDanisma/FaaliyetRaporlari

Del Carpio, X., and Wagner, M. (2016) : "The Impact of Syrian Refugees on the Turkish Labor Market." Policy Research Working Paper Series 7402.

Depuru, S. S. S. R., Wang, L. and Devabhaktuni, V. (2010): "Electricity theft: Overview, issues, prevention and a smart meter-based approach to control theft," Energy Policy 39, pp. 1007– 1015.

EUAŞ (Electricity Generation Company), (2019) : "Annual Report 2019." Available from: https://www.euas.gov.tr/tr-TR/yillik-raporlar

EUEI PDF (European Union Energy Initiative Partnership Dialogue Facility), (2017): "The Role of Sustainable Energy Access in the Migration Debate" Available from: http://www.eueipdf.org/sites/default/files/field_publication_file/the_role_of_sustainable_energy_access_in_the_migration_debate_euei_pdf_2017.pdf

Gaur, V. and Gupta, E. (2016) : "The determinants of electricity theft: An empirical analysis of Indian states." Energy Policy, 93, 127–136

Gümüşdere, E. (2004): "Theft and Losses in Turkish Electricity Sector", Sabancı University Faculty of Economics and Administrative Sciences (Master Thesis).

Golden, M. and Min, B. (2012): "Theft and loss of electricity in Indian state." International growth center, S-4010-INC-1

Greene, W.H. (2002) : "Econometric Analysis." 5th Edition, Prentice Hall, Upper Saddle River, 802.

Kumar, S. (2004): "Electricity Theft: Empowering People and Reforming Power Sector." Manohar Publication, Delhi & Institute for Development and Communication, Chandigarh.

Lochner, L.J. and Moretti, E. (2000) : "The Effect of Education on Crime: Evidence from Prison Inmates, Arrests, and Self-Reports" American Economic Review 94(1):155-189

Marangoz, C. (2013): “Illegal Electricity Use in Turkey: Causes and Policy Implications”, the Faculty of the Graduate School of Vanderbilt University(Master Thesis)

Mirza, F. M., Hashmi, M. S. and Mirza, S., M. (2015) : “Long Run Determinants of Electricity Theft in Pakistan: An Empirical Analysis.” Pakistan Journal of Social Sciences, 35(2), 599-608.

Pesaran, M. H. (2004) : “General Diagnostic Tests for Cross Section Dependence in Panels” Institute for the Study of Labor Working Papers, No:1240.

Republic of Turkey Ministry of Interior Directorate General of Migration Management, Statistics. Available from: Republic of Turkey Ministry of Interior Directorate General of Migration Management

Saini, S., Singh, R. and Satpal (2016) : “Determinant of Electricity Theft – A Case Study of CharkhiDadri.” Proceedings in: Sixth International Conference on Advanced Computing & Communication Technologies, 300-307

Smith, T. B. (2004): “Electricity theft: a comparative analysis.” Energy Policy, 32, 2067–2076

Tasdoven, H. et al. (2012): “Improving electricity efficiency in Turkey by addressing illegal electricity consumption: A governance approach.” Energy Policy, 43, 226-234

TEDAS (Turkish Electricity Distribution Company), (2009): “2009 Annual Report”, Available from: https://www.tedas.gov.tr/#!tedas_faaliyet_raporlari.

TEDAS (Turkish Electricity Distribution Company), (2010) : “2010 Annual Report”, Available from: https://www.tedas.gov.tr/#!tedas_faaliyet_raporlari.

TEDAS (Turkish Electricity Distribution Company), (2011): “2011 Annual Report”, Available from: https://www.tedas.gov.tr/#!tedas_faaliyet_raporlari.

TEDAS (Turkish Electricity Distribution Company), (2012): “2012 Annual Report”, Available from: https://www.tedas.gov.tr/#!tedas_faaliyet_raporlari.

Tumen, S. (2016) : “The Economic Impact of Syrian Refugees on Host Countries: Quasi-experimental Evidence from Turkey”,American Economic Review, vol.106, No.5, pp,456-60

TURKSTAT, (2019): Regional Statistics. Available from: http://tuikapp.tuik.gov.tr/ Bolgesel/.

United Nations Department of Economic and Social Affairs, Population Division (2017): “International Migration Report 2017”, Available from: https://www.un.org /en/ development/desa/population/migration/publications/migrationreport/index.asp

Yurtseven, C. (2015): “The causes of electricity theft: An econometric analysis of the case of Turkey.” Utilities Policy, xxx , 1-9

Wooldridge, J. M. (2010): “Econometric Analysis of Cross Section and Panel Data”, Cambridge, MA: Cambridge University Press, 2nd

APPENDICES

A. TURKISH SUMMARY / TÜRKÇE ÖZET

Elektrik, günümüz koşullarında günlük ihtiyaçların bir gereğidir ve çok fazla önem kazanmıştır. Dünyada kişi başına düşen elektrik tüketimi teknolojideki gelişmelerle her geçen yıl artmakta ve elektrik tüketiminin ekonomiye etkisi ülkeler için giderek daha önemli hale gelmektedir. Öte yandan, kaçak elektrik tüketimi hem gelişmekte olan hem de gelişmiş ülkelerde kapsamlı bir durumdur, ancak Bhattacharyya'ya (2005) göre gelişmiş ve gelişmekte olan ülkelerde elektrik hırsızlığı oranları konusunda bir fark vardır. ABD ve Batı Avrupa'da hırsızlık oranı kabaca%1-2. Öte yandan Hindistan, Malezya ve Bangladeş gibi gelişmekte olan ülkelerde elektrik hırsızlığı oranı daha yüksektir. Türkiye de bu ülkelerden biri ve 2019 Elektrik Piyasası Geliştirme Raporu'na göre ortalama% 11,4 elektrik kayıp kaçak oranına sahip ve bu Türkiye için 2019 yılında milyarlarca TL zarara neden oldu. Ayrıca Elektrik Üretim Şirketi'nin sektör raporuna göre 2019 yılı sonunda Türkiye'de üretilen elektriğin %19.96'sı ithal kömürden oluşmakta ve %18.40'ı doğalgaz ithalatına dayanmaktadır, Dolayısıyla ekonomide kırılganlık yaratan cari açık, enerji ithalatında önemli bir paya sahip. Savurgan enerji tüketimi engellendiğinde enerji ithalatı azalacak ve ülke ekonomisine olumlu etki olacaktır.

Birleşmiş Milletler Uluslararası Göç Raporu 2017'ye göre, dünya çapında uluslararası göçmen sayısı 2017'de 258 milyondur ve Türkiye, mültecilere ev sahipliği yapan ülkelerden biridir. Mülteci akınının Türkiye ekonomisi üzerinde işgücü piyasası, enflasyon, bölgesel ekonomik faaliyetler, kamu bütçesi ve ekonomik büyüme gibi önemli etkileri olabileceği açıktır. Bu anlamda Ceritoğlu ve diğerleri (2015) ve Tümen (2016), mültecilerin Türkiye'de yerlilerin işgücü piyasası sonuçları üzerindeki etkisini

incelemiş ve işgücü piyasası üzerinde önemli bir etkisi olduğunu bulmuşlardır. Dahası, Avrupa Birliği Enerji Girişimi Ortaklık Diyaloğu Aracı Raporu'na (2017) göre, mülteciler genellikle ağır koşullarla karşı karşıyadır ve enerjiye erişim eksikliği mülteciler için önemli bir sorun olabilir. Enerjiye erişim olmadan ısınma, yemek pişirme, sağlık ve eğitim hizmetleri gibi günlük ihtiyaçları karşılamak daha zor hale geliyor. Bu nedenle, göçmenlerin günlük ihtiyaçlarını karşılamak için elektrik kullanmaları gerekmektedir ve bu, göçmenlerin ağır koşulları ve kaçak elektrik tüketimini kontrol etmeyi zorlaştıran ani nüfus artışı nedeniyle Türkiye'deki kaçak elektrik tüketimini etkileyebilir.

Elektrik hırsızlığının çeşitli etkileri vardır: elektrik tüketimi ödenmemesi nedeniyle devlet gelirindeki azalma; elektrik dağıtım şirketlerinin kazançlarının düşmesi, faturalarını düzenli ödeyenler için adaletsizlik duygusunun ortaya çıkması. ve elektrik sektöründeki yatırım kaybı (Kumar, 2004). Özellikle elektrik dağıtım sektörünün özelleştirilmesinden sonra özel şirketler kârlarını artırmak için elektrik hırsızlığını önlemeye yönelik yöntemler bulmaya çalışmaktadır. Bu nedenle, elektrik hırsızlığının belirleyicilerinin anlaşılması önemlidir ve bu, şirketlerin hırsızlığı önlemelerine yardımcı olabilir. Ayrıca, bu, yasadışı hareketi engelleyerek sosyal adaleti kurtarabilir ve yatırım kararları üzerinde ve dolayısıyla ekonominin büyümesi üzerinde etkili olabilir. Altta yatan sosyo-ekonomik nedenleri olan bu yasadışı eylemi önleme çabalarının en iyi şekilde şirketlerin ve hükümetin ortak çalışmasıyla etkili olacağı tahmin edilmektedir.

Kaçak elektrik kullanımı, teknik olmayan kayıpların ana nedenlerinden biridir ve mali yük nedeniyle birçok ülke için hayati bir sorundur. Ayrıca kaçak elektrik kullanımı toplam elektrik tüketimi, elektrik fiyatları, sosyal adaletsizlik, güç kalitesi, şebeke güvenilirliği açısından elektrik sektörü üzerinde kötü etkilere sahiptir. Kaçak elektrik kullanan müşteriler enerji tasarrufuna ihtiyaç duymadan gereksiz yere enerji tüketebilmektedirler. Ayrıca, kaçak elektrik tüketimini karşılamak için yetkililer tarafından elektriğin fiyatı artırılabilir ve elektrik kesintileri ve voltaj dalgalanmaları gibi cihazların fabrikada ve evde arızalanmasına neden olabilecek teknik sorunlara yol

açabilir. Bu nedenle hükümetler ve şirketler kaçak elektrik kullanımı sorunuyla başa çıkmaya ve önlem almaya özen gösterirler.

Yasadışı elektrik tüketimi, dünyadaki en büyük sosyo-ekonomik sorunlardan biridir ve birçok çalışma, farklı politika önerileri üretilmeye çalışmıştır. Öncelikle Türkiye'de elektrik hırsızlığı ile ilgili yapılan çalışmalar hakkında bilgi vereceğiz. Bundan sonra Pakistan, Hindistan ve Latin Amerika Ülkeleri gibi hırsızlık ve kayıp oranı daha yüksek olan diğer ülkeler hakkında bilgi vereceğiz. Son olarak Suriyeli Mültecilerin Türkiye ekonomisine etkisi ile ilgili literatürü gözden geçireceğiz.

Gümüşdere (2004), Türkiye'nin farklı şehirleri arasında büyük farklılıklar gösteren elektrik hırsızlığı ve kayıplarının belirleyicilerini inceleyerek, elektrik hırsızlığı ve kayıplarının tarife tasarımı ve elektrik dağıtımının özelleştirme sürecine etkisini açıklamaya çalışmaktadır. Yazar, 1994-2001 dönemini analiz etmekte ve regresyonunda 6 kategoriye ayrılan birçok bağımsız değişken kullanmaktadır: Ekonomik Değişkenler, Uygulama Kapasitesini ve Devletin Erişimini Yansıtan Değişkenler, Devlet ve Otoriteye İlişkin Değişkenler, Dağıtım Hizmetinin Yönetsel Değişkenleri, ve Fiziksel Değişkenler. Çalışma özellikle Güneydoğu Anadolu Bölgesi'nde güçlü siyasi parti olan HADEP'in oy oranının, trafo kullanım oranının, konut elektrik tüketiminin ve verginin GSYİH'ya oranının kayıp kaçak elektriği üzerinde önemli ve olumlu etkisi olduğunu buluyor. Ayrıca, gelirin azalmasının önemli bir faktör olmadığını, ancak yoksul şehirlere sübvansiyon vermenin kayıp kaçak elektriğin maliyetini düşürmek için yararlı bir seçenek olmayacağını vurguluyor. Yurtseven (2015) ise elektrik tüketiminde gelirin önemli belirleyici bir faktör olduğunu bulmuştur. Yurtseven (2015) Türkiye için 2002- 2010 dönemine ait verileri, regresyonda panel veri yöntemi kullanmıştır.

Marangoz (2013), eğitimin kaçak elektrik tüketimi üzerinde azaltıcı etkisi olduğu sonucuna varmıştır. Yazar, hükümete eğitim yatırımını ve akıllı sayaçların kullanımını artırmasını öneriyor. Ayrıca siyasi partiler, işsizlik oranı ve nüfus kaçak elektrik tüketimini etkilemiyor ancak terörist saldırıların Türkiye'deki elektrik hırsızlığı

üzerinde arttırıcı etkisi var. Dahası, Tasdoven (2012) aynı konuyu Türkiye için araştırmaktadır ve yazar, çalışmada ekonomik düzenleme, özelleştirme, hibeler ve kamu bilgilendirme gibi yönetişim araçları için analizler yapmaktadır. Rapor, özelleştirmenin elektrik hırsızlığı ile ilgili belirtilen politikayı yönetmek için uygun bir yöntem olduğunu öne sürüyor. Öte yandan, mevcut piyasa yapısının, sistemi serbest piyasa durumuna getirecek daha kapsamlı düzenlemelere ihtiyaç duyduğunu söylemekte. Bu nedenle yazar, hibelerin ve kamuoyunun bilgisinin kalıcı olarak eklenmesinin elektrik sektöründe özelleştirme sürecinin etkinliğini artıracağını öne sürüyor. Önceki literatürden farklı olarak, bu çalışmada mültecilerinin ve özelleştirme sürecinin etkisini anlamayı hedefliyoruz.

Ayrıca dünyada kayıp kaçak elektrikle ilgili geniş bir literatür var. Özellikle Pakistan, Hindistan ve Latin Amerika ülkeleri Türkiye gibi elektrik hırsızlığından sorunlar yaşamaktadır. Bu nedenle bu ülkeleri analiz etmek modelimiz için faydalı olabilir. Mirza (2015), kaçak elektrik tüketimi ile Pakistan için belirleyicileri arasındaki uzun vadeli ilişkiyi tahmin etmeye çalışmaktadır. Yazar, çalışmada 1971-2010 dönemini analiz etmekte ve ARDL yaklaşımı kullanmaktadır. Çalışma, kişi başına düşen gelirin kayıp kaçak elektriğin üzerinde olumsuz etkisi olduğu sonucuna varıyor. Bu nedenle Pakistan'da düşük gelirli gruplar alanında kaçak elektrik kullanma olasılığı daha yüksektir. Ayrıca elektrik fiyatı ve tüketici sayısı önemli olup, uzun vadede elektrik hırsızlığı ile pozitif bir ilişki vardır. Çalışma, hükümetin Pakistan'da güçlü bir elektrik düzenleme otoritesi kurması ve sorunu çözmek için daha iyi hizmet ve dağıtım sistemi için elektrik dağıtım şirketleri arasındaki rekabeti artırması gerektiğini öne sürüyor.

Golden and Min (2012) Hindistan Eyaletlerinde 2000-2009 yılları arasında kayıp kaçak elektrik hakkında bir çalışma yapmışlardır. Çalışma, tarım ile elektrik hırsızlığı ve kaybı arasında bir ilişki olduğunu göstermektedir. Bir bölgede tarımsal faaliyetler daha fazlaysa, orada daha fazla elektrik hırsızlığı olduğunu çalıma göstermektedir. Ayrıca zengin çiftçilerin, daha fakir köylülerin oylarını kontrol etme gücüne sahip oldukları için elektrik faturalarını düşürmek için politikacıları etkileyebileceğini iddia ediyor. Ayrıca Saini (2016), Hindistan Eyaletlerindeki elektrik hırsızlığının farklı sosyo-ekonomik faktörlerini inceleyerek tarımsal faaliyetlerin kaçak elektrik tüketimi

üzerinde arttırıcı etkisi olduğunu bulmuştur. Ayrıca yazar, tarife oranı, nüfus, işsizlik, yolsuzluk, siyasi müdahale ve sıcaklığın da elektrik tüketimi üzerinde arttırıcı bir etkisi olduğunu buluyor. Öte yandan, tahsilat verimliliği, okur yazarlık, kentleşme, gelir, hukuk ve düzen, sistem verimliliği, tespit olasılığı ve ceza miktarları kaçak elektrik tüketimini azaltıcı yönde etkilemektedir.

Bu çalışmanın temel katkısı, göçmenlerinin Türkiye'deki kaçak elektrik tüketimi üzerindeki etkisini bulmaktır. Bu nedenle göçmenlerin Türkiye ekonomisi üzerine etkisiyle ilgili literatürü de inceledik. Ceritoğlu (2015) ve Tümen (2016) Suriyeli mültecilerin Türkiye'deki yerlilerin işgücü piyasası üzerindeki etkisini inceliyor. Suriyeli mültecilerin resmi çalışma izinleri olmamasına rağmen, ucuz kayıt dışı vasıfsız iş gücü sağladılar. Ceritoğlu (2015), 2013 yılında Suriyeli mültecilerin yaşadığı 10 farklı şehri analiz ediyor. Çalışma, mülteci girişlerinin Türk işgücü piyasası üzerinde gözle görülür etkileri olduğu sonucuna varıyor. Özellikle sonuçlar, mültecilerin kayıt dışı istihdamın nüfusa oranını yaklaşık 2,2 puan düşürdüğünü göstermektedir. Öte yandan yazarlar, göçmen girişinin ücretler üzerinde istatistiksel olarak anlamlı bir etkisi bulamamışlardır. Araştırmaya göre, Suriyeli mültecilerin resmi çalışma izinleri yok ve çoğu eğitimsiz, bu nedenle Türk işgücü piyasasını ancak kayıt dışı istihdam yoluyla etkileyebiliyorlar. Ayrıca Tümen (2016), Suriyeli mülteciler nedeniyle istihdamın nüfusa oranının yüzde 1,8 oranında azaldığını ve mülteci girişlerinin tüketici fiyatlarını olumsuz etkilediğini ve yüzde 2,5 oranında düştüğünü göstermektedir. Öte yandan yazar, mülteci girişlerinin yerli bireylerin ücret kazançları üzerindeki etkisinin önemli olmadığını göstermektedir. Son olarak yazar, Suriyeli mülteci girişlerinin ekonomi, sosyal yaşam ve siyaset üzerinde birçok etkisi olduğu ve bu konu hakkında birçok yeni araştırma yapılacağı sonucuna varıyor.

Bu çalışma, Mültecilerin 2009-2016 döneminde Türkiye'deki 27 ilde kayıp kaçak eklektiğe etkisi olup olmadığını sorgulamaya çalışmaktadır. Maalesef diğer illerdeki eksik veriler nedeniyle analize dahil edilememiştir. Ancak Suriyeli Mülteci oranının yüksek olduğu illere ait veriler mevcut olup analize dahil edilmiştir.

İllerdeki mülteci sayısı Türkiye İçişleri Bakanlığı Göç İdaresi Genel Müdürlüğü sitesinden alınmıştır. İllerin işsizlik oranı, eğitim oranı, kişi başına düşen gelir, nüfus yoğunluğu ve tarımsal arazi miktarı Türkiye İstatistik Kurumu'ndan alınmıştır. Türkiye Cumhuriyeti Enerji Piyasası Düzenleme Kurumu, Türkiye Elektrik Dağıtım Kurumu Raporları ve elektrik dağıtım şirketlerinden ise elektrik kayıp kaçak oranları alınmıştır.

Mültecilerin Türkiye'deki elektrik kaçağı üzerindeki etkisini analiz etmek için iki farklı yöntem kullanacağız. Panel verileri ve farklılıklardaki fark tahmin yöntemleri kullanılacaktır.Panel veri analizine baktığımızda, modelde sadece heteroskedisite sorunu var. Bu durumda modelden elde edilen sonuçlar güvenilir değildir. Bu nedenle; sağlam standart hatalar yöntemi uygulanacaktır. Bu yöntemdeki sonuçlara baktığımızda Mülteci Oranı, İşsizlik Oranı, Özelleştirme, Nüfus Yoğunluğu ve Tarımsal Arazi Miktarı modeldeki anlamlı bağımsız değişkenlerdir. Öte yandan, GSYİH ve en azından ilkokuldan mezuniyet oranı, modelde anlamsız bağımsız değişkenlerdir.

Sonuçlara baktığımızda elektrik kayıp kaçak oranı ile Mülteci Oranı arasında pozitif bir ilişki vardır. İllerde mülteci oranlarının %1 değişmesi, ilin elektrik kayıp kaçak oranının da %0.07 arttığını söyleyebiliriz. Bir diğer önemli değişken ise işsizlik oranıdır. Elektrik kayıp kaçak oranı ile işsizlik arasında pozitif bir ilişki var. İllerde işsizlik oranının %1 artması, kayıp kaçak oranın da %0.16 arttığını söyleyebiliriz. Daha yüksek işsizlik, daha az istihdam demektir ve bu nedenle meşru iş yerine, suçu seçmenin fırsat maliyetinin düşük olduğunu göstermektedir. Çünkü insanların işi yoksa bu durum insanlar için kötü ekonomik koşullara yol açacak ve elektrik faturalarını ödemek daha zor olacaktır. Ayrıca, elektrik insanların yaşamlarını sürdürmeleri için çok önemlidir, bu nedenle işsizlik insanları yasa dışı elektrik kullanmaya teşvik edecektir. Bu nedenle arttırıcı bir etki vardır.

Özelleştirme, modeldeki bir diğer anlamlı değişkendir. Sonuca göre elektrik kayıp kaçağı ile özelleştirme arasında negatif bir ilişki vardır. Elektrik dağıtımını özel sektör

kontrol ediyorsa, hırsızlık ve kayıp oranı her yıl %3 azalmaktadır sonuçlara göre. Özelleştirme sonrasında dağıtım şirketlerinin EPDK tarafından belirlenen kayıp kaçak oranı ile ilgili hedefleri bulunmakta ve hedeflere ulaştıklarında ekstra para kazanmaktadırlar. Bu nedenle dağıtım şirketleri her yıl kayıp kaçak oranını düşürmeye çalışmakta ve kaçak elektrik kullanımından kaçınmak için sistemlerini iyileştirmeye çalışmaktadır.

Sonuçlar bize nüfus yoğunluğunun önemli bir değişken olduğunu ve yoğunlukla ile kayıp kaçak elektrik arasında pozitif bir ilişki olduğunu göstermektedir. Km kare başına düşen kişi sayısının bir birim artması, illerdeki kayıp kaçak oranının da %0.002 arttırdığını söyleyebiliriz. Bu sonuç literatürle paraleldir. Çünkü kalabalık alanlarda iletim hatları ağı vardır ve hatlarda kanca bağlantısını ayırt etmek çok zordur.

Literatüre göre, GSYİH ve en az ilkokul mezuniyet oranının önemli bağımsız değişkenler ve biz de sonuçlarımızda anlamlı olmasını bekliyorduk. Ancak bu faktörler modelimizde anlamsızdır ve bunun nedenini açıklamaya çalışıyoruz.Literatüre göre GSYİH kaçak elektrik kullanımındaki en önemli faktörlerden biridir ancak bizim modelimizde önemsizdir. İllerin gelir dağılımları dengesiz olabilir ve ekonomik durumu kötü olan insan miktarı bu değişkene yansıtılmayabilir, bu nedenle modelde GSYİH önemsiz olabilir. Ayrıca 27 il için eğitim düzeyi önemsizdir. Bu illerde eğitim seviyesinin elektrik hırsızlığı üzerindeki etkisini göremedik ve bu durum onlar için özel bir durum olabilir.

İkinci modelimiz, farkların farkı (DID) tahminidir. DID, olayın veya politikanın etkisini değerlendirmek için tedavi ve kontrol gruplarını kullanan doğal bir deney yöntemidir. Bu yöntemde, olay öncesi bir birim örneklemini gözlemleyebiliyoruz ve sonrasında aynı birimi olay gerçekleştikten sonra gözlemliyoruz. Yani bu modelde kontrol grubu politikadan veya olaydan etkilenmez ve tedavi grubu politikadan etkilenir. Politika uygulandıktan sonra, bu yöntem tedavi grubunun ve kontrol grubunun sonuç değişkenindeki zaman içindeki ortalama değişimi karşılaştırır. Bu

metodolojiyi kullanarak, göçmenlerin elektrik hırsızlığının etkisini modelimizde inceleyebiliriz.

Bu modelde, iki kukla değişken oluşturuyoruz: S tedavi grubunda 1, kontrol grubunda 0 ve göç sonrası dönemde 1, göç öncesi dönemde 0 alan başka bir kukla değişken T. Esas olarak Ceritoglu (2015) 'u takip ediyoruz ve DID denklemimiz aşağıdaki gibi formüle edildi:

$$TLR_{it}=C_{it}+\lambda_1 UNMR_{it}+ \lambda_2 ER_{it} +\lambda_3 Log(GDP_{it})+ \lambda_4 PD_{it} + + \lambda_5 Log (AGR_{it})+\lambda_6 PRVt_{it} + \lambda_7 S_i +\lambda_8 T_i+ \lambda_9 (S_i \times T_i)+\varepsilon_{ij}$$

Ayrıca, modeli S ve T'yi kaldırarak ve sırasıyla kj ve kt ile gösterilen bir kesit ve yıl sabit etkileri ekleyerek ifade edebiliriz. Yani denklemimiz şu olacak:

$$TLR_{it}=C_{it}+\lambda_1 UNMR_{it}+ \lambda_2 ER_{it} +\lambda_3 Log(GDP_{it})+ \lambda_4 PD_{it} + + \lambda_5 Log(AGR_{it}) +\lambda_6 PRVt_{it} + \lambda_9 (S_i \times T_i)+k_j+k_t+\varepsilon_{it}$$

Bu bölümde Mülteci oranının daha yüksek olduğu illerde mülteci girişinin elektrik kayıp kaçak oranı üzerindeki tahmini etkisini gösteriyoruz. Öncelikle bir yılda en az %1 Mülteci oranına sahip olan illeri "tedavi alanı", ortalama %0'a yakın Mülteci oranına sahip illeri "kontrol alanı" olarak adlandırıyoruz. Tedavi illeri Kilis, Osmaniye, Gaziantep, Şanlıurfa, Şırnak, Adana, Kayseri Mardin, Hatay, Mersin, Diyarbakır, Siirt ve Ankara'dır. Bu illerin Mülteci oranı daha yüksektir, örneğin; 2016 yılında Kilis %94, Hatay %24, Şanlıurfa %21 ve Gaziantep %16 mülteci oranına sahiptir. Öte yandan Artvin, Bartın, Bayburt, Erzincan, Gümüşhane, Giresun, Karabük, Kars, Kastamonu, Kırıkkale, Rize Trabzon, Zonguldak ve Çankırı kontrol grubumuzdur ve Mülteci oranı daha düşüktür. Arıtma ve kontrol grubu illerine baktığımızda, elektrik dağıtım şirketleri aynı amacı güdüyorlar ve kârlarını artırmak için elektrik kayıp kaçak oranlarını düşürmeye çalışıyorlar. Ayrıca 2009 yılında yüzde

31 civarında olan tedavi grubunun elektrik kayıp kaçak oranları ortalaması 2012'de hemen hemen aynıdır. Bu durum kontrol grubu için de benzerdir. 2009 yılında yüzde 10 civarında olan kontrol grubunun elektrik kayıp kaçak oranları ortalaması 2012 yılında hemen hemen aynıdır, bu nedenle tedavi ve kontrol grubunun tedavi öncesi aynı eğilimi olduğunu söyleyebiliriz.

2009-2011'i göç öncesi dönem, 2012-2016'yı ise göç sonrası dönem olarak belirledik. Modelimize il ve yıl sabit etkisi ekliyoruz ve mülteci girişlerinin elektrik kayıp kaçak oranı üzerindeki etkisini görüyoruz. Birinci değişken olan DID tahmincimiz, Türkiye'deki tedavi alanlarına gelen mülteci girişinin, kontrol grubu illerine göre tedavi grubu illerinde elektrik hırsızlığı ve kayıp oranını 2 puan artırdığını göstermektedir.

2009-2012'i göç öncesi dönem, 2013-2016'yı ise göç sonrası dönem olarak belirlediğimizde ise mülteci girişlerinin elektrik kayıp kaçak oranı üzerindeki etkisini görüyoruz. Birinci değişken olan DID tahmincimiz, Türkiye'deki tedavi alanlarına gelen mülteci girişinin, kontrol grubu illerine göre tedavi grubu illerinde elektrik hırsızlığı ve kayıp oranını 3.2 puan artırdığını göstermektedir.

Şimdi yılda en az %2 civarında Mülteci oranına sahip olan illeri “tedavi alanı”, %0'a yakın Mülteci oranına sahip illeri “kontrol alanı” olarak tanımlıyoruz. O yüzden Ankara, Diyarbakır ve Siirt'i Tedavi grubumuzdan düşürüyoruz. 2009-2011'i göç öncesi, 2012-2016'yı ise göç sonrası dönem olarak belirledik. DID tahmincimiz, Türkiye'deki tedavi alanlarına gelen mülteci girişinin, kontrol grubu illerine göre tedavi grubu illerinde elektrik hırsızlığı ve kayıp oranını 2.2 puan artırdığını göstermektedir.

2009-2012'i göç öncesi dönem, 2013-2016'yı ise göç sonrası dönem olarak belirlediğimizde ise mülteci girişlerinin elektrik kayıp kaçak oranı üzerindeki etkisini görüyoruz. Birinci değişken olan DID tahmincimiz, Türkiye'deki tedavi alanlarına

gelen mülteci girişinin, kontrol grubu illerine göre tedavi grubu illerinde elektrik hırsızlığı ve kayıp oranını 3.5 puan artırdığını göstermektedir.

Bu tezde, göçün Türkiye'deki elektrik sektöründe önemli bir etkiye, yani elektrik kayıp kaçağına yol açıp açmadığını anlamak için bir ekonomik model geliştiriyoruz. Elektrik hırsızlığı, elektrik dağıtım şirketleri ve devlet için çok önemli bir sorundur. Örneğin 2016 yılında dağıtım şirketlerinin elektrik hırsızlık ve kayıp oranları ortalaması %13,41'dir. Türkiye'de kaçak elektrik kullanımı nedeniyle kayıp kaçak oranları çok yüksek ve faturalarını düzenli ödeyen tüketiciler bu kaybın sorumluluğunu üstleniyor. Bunun sosyal adalet ve bölgesel düzeyde yatırım kararları üzerinde olumsuz etkisi vardır, bu nedenle elektrik hırsızlığının azaltılması ülkelerin en büyük beklentilerinden olmasından dolayı ve kaçak elektrik kullanmanın sosyo-ekonomik arka planını anlamak bu davranışı önlememize yardımcı olacaktır.

Bulgularımız, mülteci göçü sonrasında Türkiye'deki elektrik kayıp kaçak oranında hem panel verileri hem de farkların farkı metodu kullanılarak incelendiğinde bir artışa sebep olduğunu göstermektedir. Panel verileri bize illerdeki mülteci oranının %1 artmasının, ilin elektrik kayıp kaçak oranının da %0.07 arttığını gösteriyor. Farkların farkı tahmininde, bir yılda en az %2 civarında Mülteci oranına sahip olan illeri tedavi grubu olarak modele dahil ettiğimizde ve 2013-2016'yı göç sonrası dönem olarak belirlediğimizde, Türkiye'deki yüksek mülteci sayısına sahip olan illerin, neredeyse sıfır yüzdeye yakın mülteciye sahip illere göre elektrik kayıp kaçak oranının 3,5 puan arttırdığını görmekteyiz.

Modelimizde Türkiye'de kaçak elektrik tüketimini önemli ölçüde etkileyen diğer değişkenler işsizlik oranı, özelleştirme, nüfus yoğunluğu ve tarım arazisi miktarıdır. Özelleştirme ve tarım arazisi miktarı kaçak elektrik kullanımının önlenmesinde önemli bir etkiye sahipken, işsizlik oranı ve nüfus yoğunluğu kaçak elektrik tüketimini artırıcı etkiye sahiptir. Öte yandan, GSYİH ve eğitim seviyesi modelde önemsiz bağımsız değişkenlerdir. Bu nedenle, hükümet ve şirketler, elektrik hırsızlığını önleme stratejilerini belirlemek için bu faktörleri dikkate almalıdır.

B. THESIS PERMISSION FORM / TEZ İZİN FORMU

(Please fill out this form on computer. Double click on the boxes to fill them)

ENSTİTÜ / INSTITUTE

Fen Bilimleri Enstitüsü / Graduate School of Natural and Applied Sciences ☐

Sosyal Bilimler Enstitüsü / Graduate School of Social Sciences ☒

Uygulamalı Matematik Enstitüsü / Graduate School of Applied Mathematics ☐

Enformatik Enstitüsü / Graduate School of Informatics ☐

Deniz Bilimleri Enstitüsü / Graduate School of Marine Sciences ☐

YAZARIN / AUTHOR

Soyadı / Surname : Genç
Adı / Name : Akın Can
Bölümü / Department : İktisat / Economics

TEZİN ADI / TITLE OF THE THESIS (**İngilizce** / English): THE IMPACT OF IMMIGRANTS ON ILLEGAL ELECTRICITY CONSUMPTION: CASE OF SYRIAN IMMIGRANTS IN TURKEY

TEZİN TÜRÜ / DEGREE: **Yüksek Lisans** / Master ☒ **Doktora** / PhD ☐

1. **Tezin tamamı dünya çapında erişime açılacaktır. /** Release the entire work immediately for access worldwide. ☒
2. **Tez iki yıl süreyle erişime kapalı olacaktır.** / Secure the entire work for patent and/or proprietary purposes for a period of **two years. *** ☐
3. **Tez altı ay süreyle erişime kapalı olacaktır.** / Secure the entire work for period of **six months**. ***** ☐

***** *Enstitü Yönetim Kurulu kararının basılı kopyası tezle birlikte kütüphaneye teslim edilecektir. / A copy of the decision of the Institute Administrative Committee will be delivered to the library together with the printed thesis.*

Yazarın imzası / Signature ..... **Tarih** / Date .....
(Kütüphaneye teslim ettiğiniz tarih. Elle doldurulacaktır.)
(Library submission date. Please fill out by hand.)

Tezin son sayfasıdır. / This is the last page of the thesis/dissertation.