The Cost of Separatist Conflict in Turkey: A note on Bilgel and Karahasan (2017)

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Abstract

One of the most important problems has been terrorism for the Turkey since the mid-1980s, hence the terrorism has a negative effect on economic development. In this study, I investigate the economic costs of terrorism known as (Kurdistan Workers' Party) PKK, which most influences the south of Turkey. In doing so, I create a synthetic control unit which was not exposed to terrorism and then I compare the real per capita GDP gap between the actual and synthetic provinces. I reveal that after the outbreak of terrorism the real per capita GDP in Eastern and Southeastern Anatolia declined by about 5.7 percent relative to its synthetic counterpart without terrorism in the period 1975-2010.

Contents

1   Introduction

Terrorism has a strong effect on the economy and has been a trouble through long ages in all around the world. Terrorism affects the economy, not only on the GDP, but also on different economic fields, such as human and physical capital stock, military expenditures and shifts resources from the productive sector to the defense industry. In addition, these terrorist activities have also had very significant consequences, as they have forced the Turkish governments to finance counterterrorism measures and in return, have burdened the economy. Terrorist incidents have also economic consequences by diverting foreign direct investment (FDI) or limiting trade. If a developing country loses enough FDI, which is an important source of savings, then it also experiences reduced economic growth. However the conflict negatively affected not only the directly attacked regions, but also the national economy.

In order to examine the effect of terrorism in Turkey, I investigate the economic costs of political and armed conflict known as (Kurdistan Workers' Party) PKK terrorism by using the synthetic control method (SCM) developed by Abadie and Gardeazabal (2003). I create a synthetic control group that mimics the economic characteristics of the provinces which were not exposed to terrorism. I then compare the real per capita GDP of the provinces which were extremely exposed to terrorism to its synthetic counterpart without terrorism for the period 1975-2010. I obtain that after the outbreak of terrorism, the annual real per capita GDP on average in Eastern and Southeastern Anatolia declined by about 5.7 percent relative to its synthetic counterpart without terrorism in the period 1975-2010. I show that this causal gap increases until 2000 and begins to decrease after the same year due to vanishing of terrorist activity until 2010. The results are robust to the exclusion of any weight-assigned province from the donor pool of available control provinces.

In this article, I investigate the causal effect of separatist terrorism by using the synthetic control method instead of the classic regression framework. Thus the method helps us to isolate the problems of heterogeneity, endogeneity and extrapolation biases. Unlike using a cross-country analysis, such as aggregate measures of terrorism (e.g. Domestic vs. International or radical Islamist), I only focus on the case of the PKK terrorism (separatist), which allows us to minimize heterogeneity biases.

This paper heavily draws on Bilgel and Karahasan (2017), they investigate the impact of terrorism in the period of 1975-2001. They employ the Synthetic Control Method in order to measure the effect of terrorism on real GDP and they find that an average gap of about 7 percent between the actual real GDP of Eastern and Southeastern Anatolia and the real GDP of a comparable synthetic Eastern and Southeastern Anatolia without terrorism. Our paper departs from Bilgel et al. (2017) in several aspects. First, instead of using the period of 1975-2001, I extend the sample period until 2010 in order to see the effect more specifically. In the course of time, there have been several cease fires and hesitancies and they might been caused by changing the impact of terrorism. Second, apart from in-space placebo experiments I also pose two more sensitivity tests which are in-time placebo test and leave-one-out analysis, in order to verify the robustness of the result.

Although our data initially contained the period of 1975-2013 but I removed the years after 2010 due to attacks of other terrorist groups such as ISIS (Islamic State of Iraq) have been more intense and might be affecting the region which I pose in our framework. In doing so, I aim to isolate only the effect of PKK terrorism.

To the best of our knowledge the synthetic control method has been used on PKK terrorism by Bilgel and Karahasan (2017). In general, the synthetic control method advocated in different cases of terrorism, such as the case of ETA by Abadie and Gardeazabal (2003). Unlike ETA terrorism, the PKK terrorism mostly influences the least developed provinces of Turkey. Apart from that, there have been several investigations of analyzing the economic costs of conflicts. Krueger et al. (2003) finds a causal connection in general between education and terrorism and suggests that a reduction in poverty or an increase in educational attainment would meaningfully reduce international terrorism. Merely, not all the research in the same field supports the same result. Derin-Gure (2010) find that there is no causal relationship between economic conditions in Southeastern Turkey and separatist terrorism by using Vector Autoregression methodology (VAR).

The paper is organized as follows. Second section reviews the concepts and definitions of synthetic control method and constructs the model. Section 3 describes the regional differential of Turkey and the history of separatist terrorism (PKK) that are necessary for understanding the economic consequences of terrorism. Section 4 reviews data and sample, whereas section 5 presents the results which I obtain and the placebo experiments.

2 Synthetic Control Method for Comparative Studies

2.1 Comparative Case Studies

Case studies usually aim to detect the effect of an event or intervention, in order to measure whether the effect is large or small according to the outcome variable. Hence, case studies are feasible when some units are under the effect or exposure and others are not (at least their exposure should differ).

Synthetic Control Method provides quantitative support for case studies by creating a synthetic control region that simulates what the outcome path of a region would be if it did not undergo a particular policy intervention. The SCM creates this hypothetical counterfactual region by taking the weighted average of pre-intervention outcomes from selected donor provinces. The donor provinces that combine to form the synthetic control are selected from a pool of potential candidates. Predictor variables that affect the outcome and the outcome variable itself before the intervention is enacted determine the selection of donor provinces and weights.

2.2 Construct the Model

The following simple model provides a rationale for the SCM in comparative case study research. Suppose that we observe $J + 1$ regions. Without loss of generality, suppose also that only the first region is exposed to the intervention of interest, so that we have J remaining regions as potential control. Borrowing from the statistical matching literature, we refer to the set of potential controls as the "donor pool". Also, without loss of generality and to simplify the notation, assume that the first region is uninterruptedly exposed to the intervention of interest after some initial intervention period.

Let Y_{it}^N be the outcome that would be observed for the region i at time t in the absence of the intervention, for units $i = 1, ..., J + 1$, and time periods $t = 1, ..., T$ Let T_0 be the number of preintervention periods, with $t = 1, ..., T_0$. Let Y_{it}^I be the outcome that would be observed for unit i at time t if unit i is exposed to the intervention in periods $T_0 + 1$ to T. We assume that the intervention has no effect on the outcome before the implementation period, so for $t \epsilon 1, ..., T_0$ and all $i \epsilon 1, ..., N$, we have that $Y_{it}^I = Y_{it}^N$. In practice, interventions may have an impact prior to their implementation (e.g., via anticipation effects). In those cases, T_0 could be redefined to the first period in which the outcome may possibly react to the intervention. Implicit in our notation is the usual assumption of no interference between units (see Rosenbaum 2007 for a detailed discussion of the assumption of no interference between units). That is, we assume that outcomes of the untreated units are not affected by the intervention implemented in the treated unit.

Let $\alpha_{it} = Y_{it}^I - Y_{it}^N$ be effect of the intervention for unit i at time t, and let $D_i t$ be an indicator that takes value one if unit i is exposed to the intervention at time t, and value zero otherwise. The observed outcome for unit i at time t is

$$Y_{it} = Y_{it}^N + \alpha_{it} D_{it}.$$

Because only the first region is exposed to the intervention and only after period T_0 (with $1 \leq T_0 < T$), we have that

$$D_{it} = \begin{cases} 1 & \text{if } i = 1 \quad \text{and} \quad t > T_0, \\ 0 & \text{otherwise.} \end{cases} \tag{1}$$

We aim to estimate $(\alpha_{1T_0+1}, ..., \alpha_{1T})$. For $t > T_0$,

$$\alpha_{1t} = Y_{1t}^I - Y_{1t}^N = Y_{1t} - Y_{1t}^N.$$

Because Y_{1t}^I is observed, to estimate α_{1t} we just need to estimate Y_{1t}^N.

In the synthetic control method, the control units are assigned as a weighted average that the pre-terrorism per capita GDP and other covariates that are thought to influence per capita GDP. In our case, I set the covariates such as an average of per capita GDP growth before the intervention period and all the lagged variable of per capita GDP before the intervention.

3 Regional Differential and History of The PKK Terrorism

3.1 Regional Differential

Regional differential is one of the most important struggles in Turkey. There have been several politic implementations in order to reduce the inequality of regions since 1960s. Karaca (2004) finds an empirical evidence that differential of regions increases by the time. While the real per capita GDP increases in the Western Regions, it decreases for the Eastern and Southeastern Anatolia. In fact, the per capita real GDP is above average of the Turkey in the Western Regions but not in the Eastern and Southeastern Anatolia. There have been many arguments about that terrorist activity might be emerging in the Eastern and Southeastern Anatolia due to low level of income.

Feridun and Sezgin (2008) find out an evidence that agriculture and government services are more important components of GDP in explaining terrorism compared with other factors, such as trade, construction, manufacturing. They also analyze the convergence of the regions and they obtain the lowest values for East and Southeastern Anatolia.

On the other hand, Tekeli (1992) relates this inequality with the historical roots of the Turkish economy and underlines the social and economic determinants of regional imbalances. Tekeli (1992) gives two reasons of the structure of the Turkish economy: one is the insufficiency of Turkey with Aleppo and its surroundings in the south. The other is the postwar era that results in a sudden sharp fall in the productive and young labor force during the early ages of the Republic and loss in the young and productive labor force, especially in the Eastern geography of Turkey. Additionally, ongoing terrorist activity also induces for loosing the young generation and productivity. Derin and Gure (2009) find that when a country is richer the country's nationals commit fewer terrorist attacks at home. Low levels of development lead to terrorism.

As a consequence, terrorist activity increases the imbalances in the income level of Turkish provinces. For this reason, Karaca (2004) also mentions that there is a divergence between the income of the western regions and Eastern regions instead of convergence. It seems that the income inequality will be increasing in the course of time.

Figure 1 maps the distribution of the provincial income for the period of 1975-2013. As it is seen, provinces in the Eastern and Southeastern Anatolia mostly on the lowest

income quartile of the country (grey colors) while western regions and central Anatolia in general well above the average per capita income of the country (dark and light red colors).

In short, provinces are located in the Marmara region, Aegean and the Mediterranean Regions and around the capital city Ankara represent the highest income quartile of the country during the period of 1975-2013.

During the almost 40 years, while around of Ankara and western regions were improving, the Eastern and Southeastern regions remain stable as their old version in 1975. As Karaca (2004) mentions that the convergence struggle is far from decreasing the gap between the regions and it will not stop the increasing.
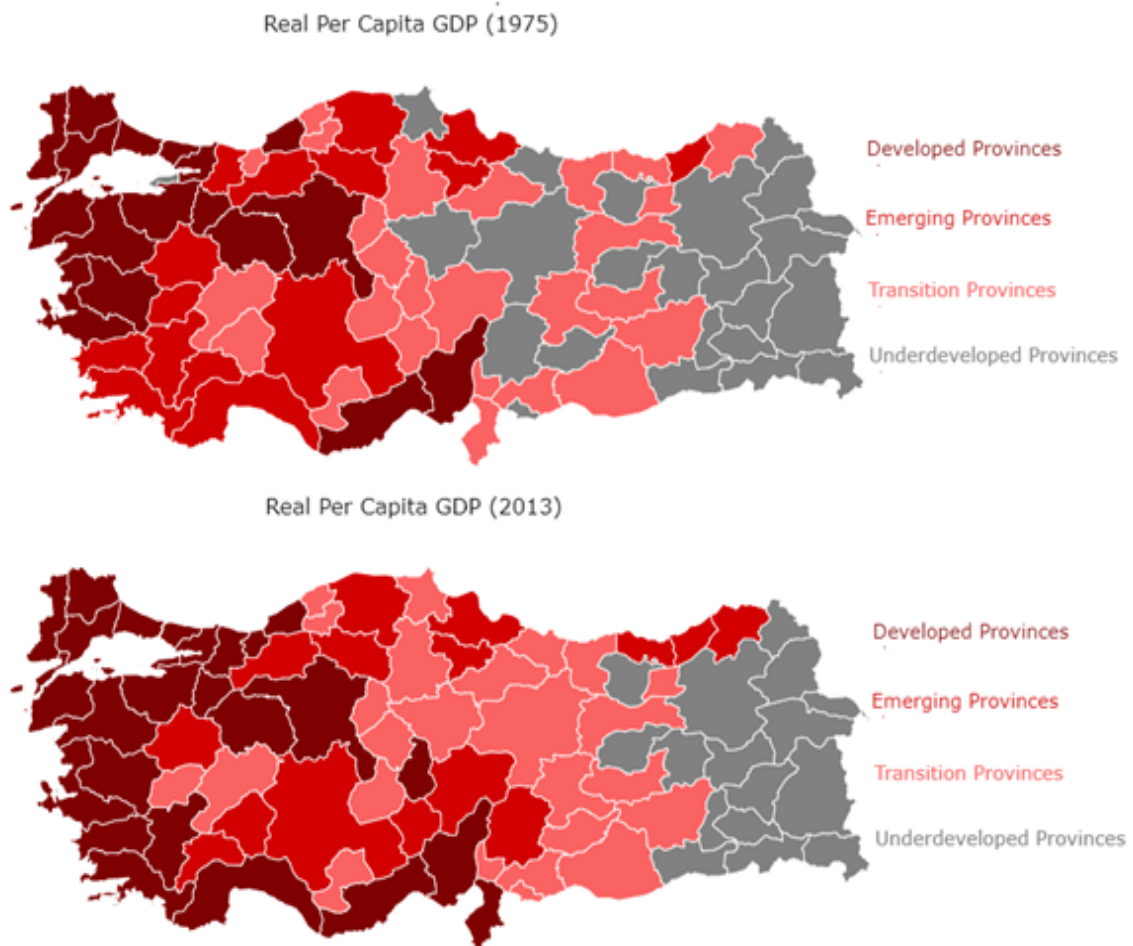
Real Per Capita GDP (1975)

Real Per Capita GDP (2013)

Figure 1: Distribution of income by Provinces

3.2   The history of Separatist Terrorism

There have been many arguments about the origins of the Kurds, which are: Iran (farsi) origin, Arabian origin, Assyrian origin and Armenian origin or Turk origin. However, all remain only as a claim.

On the other side, French revolution began in 1789 and with its principle of nationalism and freedom. Thus, some authorities or origins under the Ottoman Empire had started to rebellion movement. No doubt, the French revolution was one of the important impact on the dismemberment of the Empire. Firstly, the first movement had occurred by Seyh Ubeydullah in 1879, in order to establish an independent country, but the revolt had suppressed in a little while by Ottoman Empires. After on, the impact of the Soviet Union came to area by contacting with leaders of the Kurdish tribes and trying to affect them for separatist movements.

The other important person was Seyh Sait and he had a big power and prestige in Kurdish society. His rebellion movement was the most important one during the historical root of Turkey. He claimed his aim as only protecting Islam and again repressed by Mustafa Kemal Ataturk. Later on, The Kurdistan Workes' Party, or PKK (in Kurdish: Partiya Karkerên Kurdistanê) established on 27 October 1978 by Abdullah Ocalan by aiming to found an independent state in the region which contains the Southeastern Turkey, Northern Iraq and Northern Syria.

The PKK's ideology was originally a fusion of revolutionary socialism and Kurdish nationalism, seeking the foundation of an independent, Marxist–Leninist state in the region, which was to be known as Kurdistan.

PKK imposed its first acts during the pre-1980 period, but after the military coup of 1980, the PKK activity stopped until the civilian regime resumed in 1983 and took advantage of the political repression by gaining more strength and participants. By 1984, PKK resumed its first terrorist activities in Hakkari and Siirt. Accordıng to parliamentary commission report, between 1984-2012, 7,918 public officers, 5,557 civilians, 22,101 terrorists were killed in PKK activities.

Figure 2 plots the intensity of PKK terrorist activity since 1981, measured by the number of fatalities and injuries. Data is collected from the Global Terrorism Database (GTD) and verified from the newspaper reports in order to check chronology.

On October 1989, Turgut Ozal became the president of the Republic of The Turkey and his period witnessed an out of conflict between Kurdish-Turkish political struggle. Turgut Ozal stated that he would be willing to allow broadcasting in Kurdish language and open to discuss a federal system. Thus, PKK declared its first cease fire in March 1993. After death of Ozal, the National Securıty Council announced that PKK members who have not been involved in terrorist attacks would be pardoned if they surrendered.
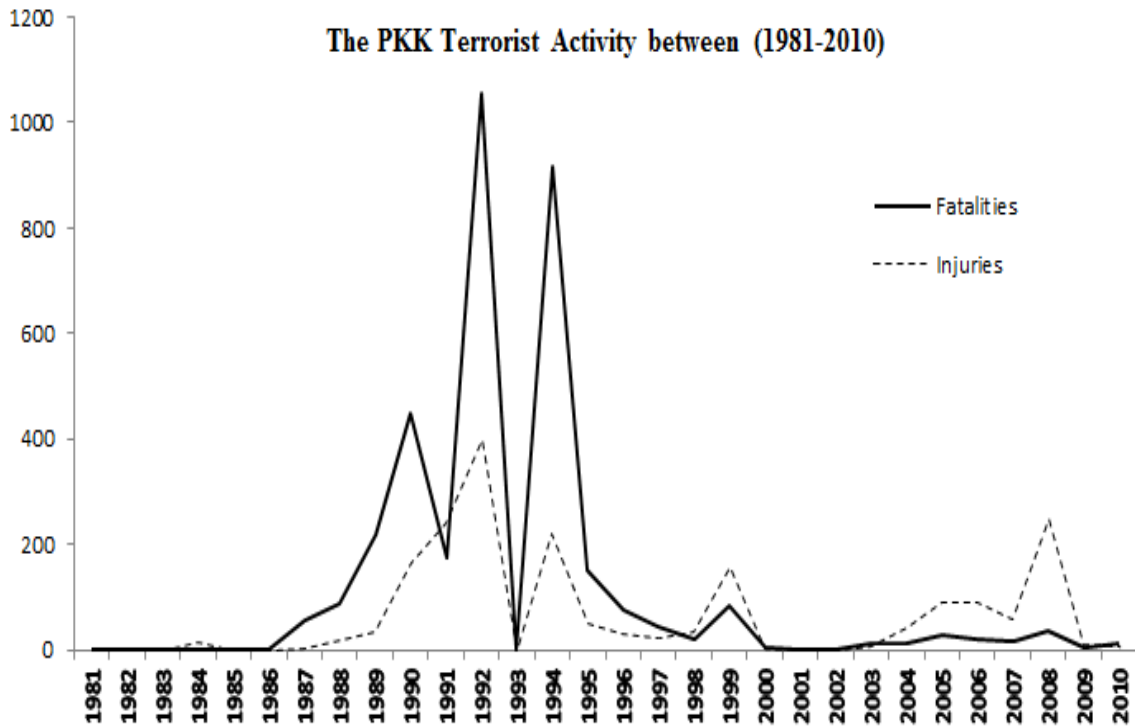
Figure 2: PKK Terrorist Activity (1981-2015)

The PKK terrorism declared 7 cease-fires in the period of 1993-2010 and the longest one was between 1999-2004. The most intense years for PKK activities was in the period of 1990-1994 which about 2593 people were killed and 1022 people were injured on the average.

On February 1999, Abdullah Ocalan was captured in Kenya and after on some people who belonged to PKK groups surrendered. However, The PKK terrorism declared a cease-fire once more and lasted until 2004. During this period, PKK stated a tactical and structural change and declared a formal end to its terrorist activities. The aim was to show that the their acts were not more than democratic ways. Thereat, The PKK is listed as a terrorist organization by several states and organizations, including the North Atlantic Treaty Organization (NATO), the United States and the European Union.

Consequently, The PKK changed its name to KADEK (in kurdish: Partiya Karkerên Kurdistanê/Kurdistan Freedom and Democracy Congress) in order to operate as a legal and legitimate organization and to avoid being listed as a terrorist organization. Even though, the organization continued to carry out terrorist activities.

4   Data and Sample

I use province-level panel data for the period 1975-2010. Our sample period begins in 1975 because it is the earliest year for which data on real per capita GDP is available and our sample period ends in 2010. Our data initially also contained the years until 2013 but I dropped the last 3 years because of the ISIS (Islamic State of Iraq) began its activ-

ities after 2010 and it was tough to isolate the effect of PKK terrorism. For this reason I removed all the variables for the last three years in order to avoid the overlap treatment. Unlike the paper of Bilgel and Karahasan (2017), which they analyze the cost of terrorism in the period of 1975-2001 , I extend the sample until 2010 and try to measure the impact of terrorism in the period of 1988-2010.

Our data contains 67 provinces in total but currently there are 81 provinces in Turkey which 14 of them became province after 1989. In order to avoid the problem, I aggregated these 14 new provinces into the existing 67 provinces.

Figure 3 plots the intensity of the PKK activities province by province in the period of 1975-2015. As shown in the map, 30 were exposed to terrorist activity during the period. However, some of them were exposed to terrorism with very few casualties so I shifted them into the donor pool. Hence, the most intense terrorist activity is located in Eastern and Southeastern Anatolia. Data is collected by Global Terrorism Database and also checked out by The Turkish General Staff in order to verify some details.
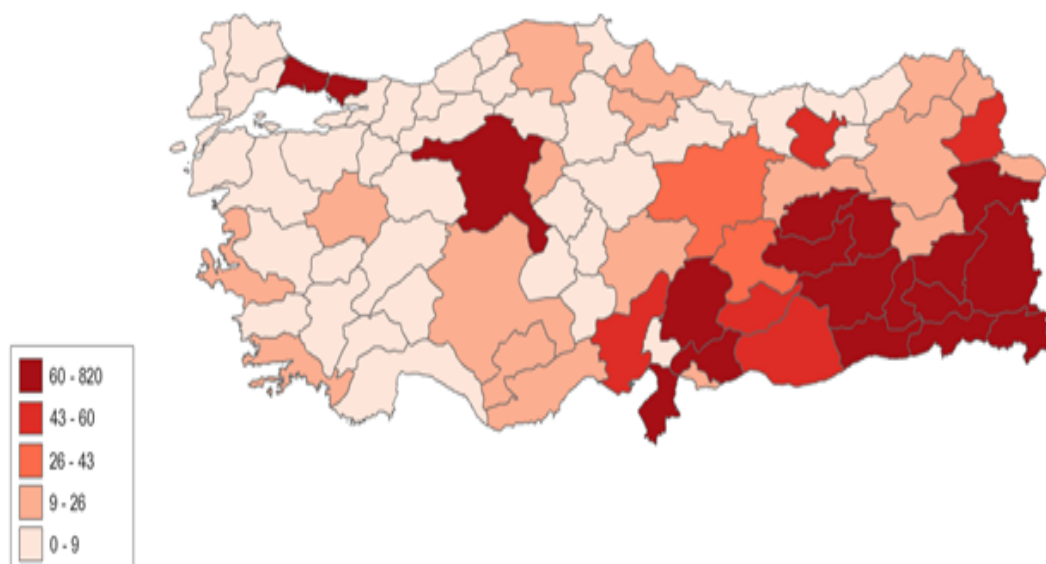

Figure 3: Terrorist Activity: Number of incidents on average by Provincial (1975-2015)

To isolate the terrorism impact on the real GDP, the treated unit should not have had any structural shock, such as earthquake, natural disaster or economic crises. There were seven economic crises during the sample period, but the effect was nationwide which means affect the all the units, therefore, these effects do not invalidate the synthetic control estimates.

Nevertheless, there were also some several disasters which affect some units in the sample period. However, I removed these units from both treated and synthetic control units. Diyarbakir in 1975, Van in 1976, Erzurum in 1983 and Erzincan in 1992 from treated units and Afyon in 1995, Adana in 1998, Kocaeli and Bolu in 1999 discarded from donor pool because of both disasters and earthquakes. Additionally, I also removed the wealthiest province Istanbul from among the treated unit because its inclusion might

undermine the impact of terrorism. This leave us with a total 43 provinces in the donor pool and 15 potential provinces which were exposed to terrorism.

Consequently, in order to satisfy the requirement of long pre-terrorism period and the convex-hull criteria, I finally dropped four more provinces from treated unit Hakkari, Siirt, Mardin, Ağri which were exposed to terrorism but at the same time they were fairly poorer. I aggregated the 11 treated provinces into the one by taking a population-weighted average.

Figure 4 represents both the treated and the control provinces in the sample and as clearly seen on the map, provinces with the red colors are the treated units which are located in the Eastern and Southeastern Anatolia and control provinces with the light red colors which are in the rest of the country. The control units contain 43 provinces in total while treated units contain only 11 provinces. The 11 treated units represent respectively Adıyaman, Bingol, Bitlis , Elazig, Gaziantep, Kahramanmaras, Kars, Malatya, Mus, Sanliurfa and Tunceli.
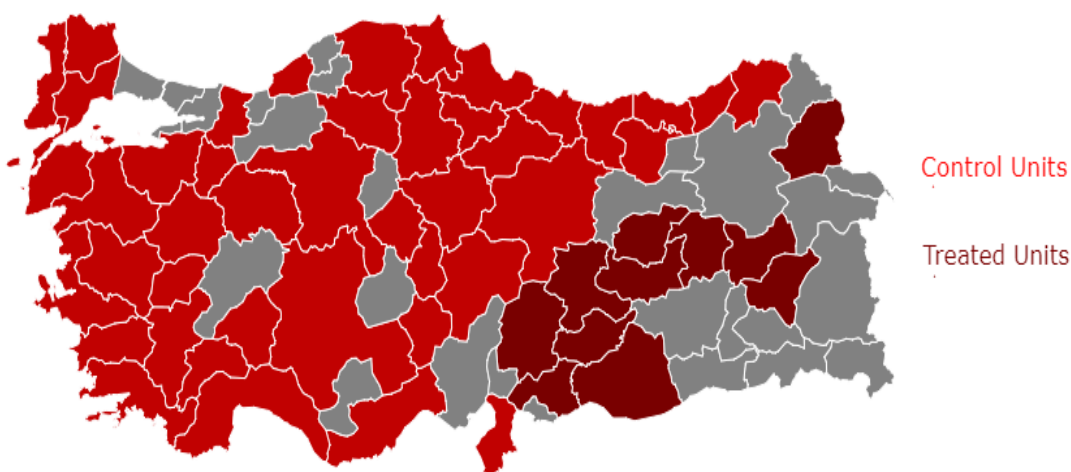

Figure 4: Control and Treated Units in the Sample

The first year of pre-treatment period for our sample is 1975 and the last year of pre-treatment period is 1987. For the post-treatment period the first year is 1988 and the last year is 2010. That is to say, our sample contains 23 years of post-treatment and 13 years of pre-treatment period.

For outcome variable in our sample, I use the provincial real per capita GDP for every year and all lagged observations of per capita real GDP between 1975-1987, and the average per capita real GDP growth rate over the pre-treatment period between 1975-1987 as predictors.

Our real GDP data comes from the different sources. The earliest provincial per capita GDP data is collected from Ozotun (1980) for the period 1975-1978; Ozotun (1980) for

the period 1979-1986, the Turkish Statistical Institute (TURKSTAT) for the period 1987-2001 and 2001-2013 by Economic Policy Research Foundation of Turkey (TEPAV).

5 Results

As I mentioned before, I set the synthetic Eastern and Southeastern Anatolia as the convex combination of the provinces in the donor pool that most closely resembled treated provinces (see table 1). The result is displayed in Table 2, which shows the differences between Synthetic Eastern and Southeastern Anatolia and actual Eastern and Southeastern Anatolia. I diverge the our sample into the six parts in order to see difference and loss clearly.

Table 1 demonstrates that weights of each control province in the synthetic Eastern and Southeastern Anatolia. The weights reported in table 1 indicate that Eastern and Southeastern Anatolia is best reproduced by a combination of Ankara, Giresun, Gumushane, Mugla, Sivas, and Tokat. All other provinces in the donor pool are assigned zero W-weights.

Province	Weight	Province	Weight
Amasya	0	Kayseri	0
Ankara	0.021	Kirklareli	0
Antalya	0	Kirsehir	0
Artvin	0	Konya	0
Aydin	0	Kutahya	0
Balikesir	0	Manisa	0
Bilecik	0	Mugla	0.086
Burdur	0	Nevsehir	0
Bursa	0	Nigde	0
Canakkale	0	Ordu	0
Cankiri	0	Rize	0
Corum	0	Sakarya	0
Denizli	0	Samsun	0
Edirne	0	Sinop	0
Eskisehir	0	Sivas	0.055
Giresun	0.227	Tekirdag	0
Gumushane	0.404	Tokat	0.167
Hatay	0	Trabzon	-
Isparta	0	Usak	-
Icel(Mersin)	0	Yozgat	-
Izmir	0	Zonguldak	-
Kastamonu	0		

Table 1: Calculated weights of control units in the donor pool

Figure 5 plots the trajectories in the per capita real GDP for Eastern and Southeastern Anatolia and the rest of Turkey over the period 1975-2010. Even before the outbreak of the terrorism the time series of real per capita GDP for Eastern and Southeastern Anatolia and the rest of Turkey differed notably. During the 1975-1980 trends are similar but after the intervention trends start to diverge while both were rising up.
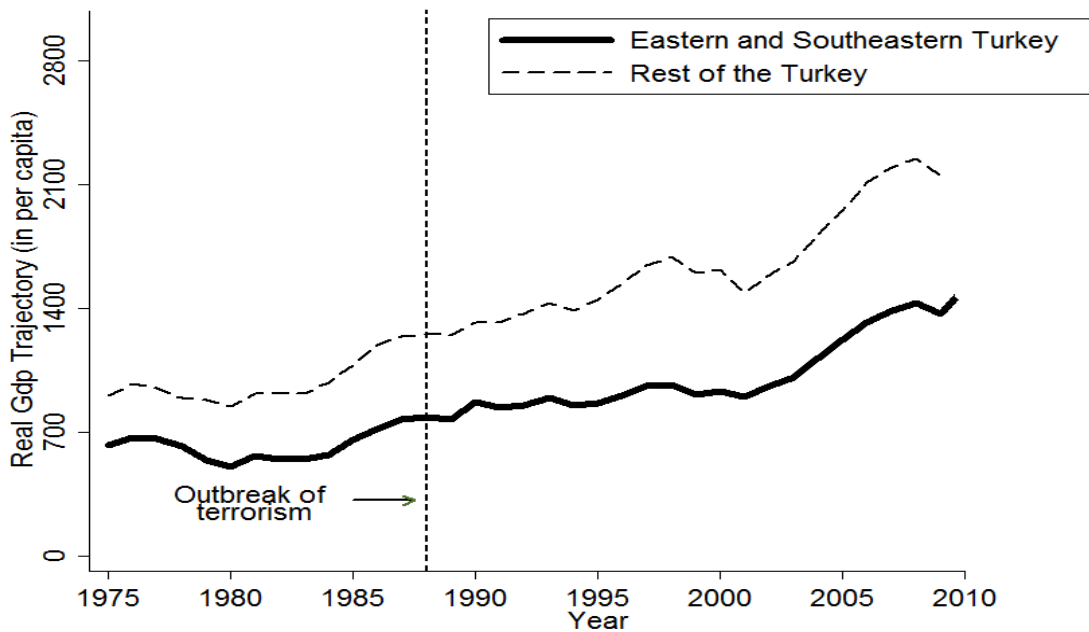

Figure 5: Trends in per capita Real GDP: Eastern and Southeastern Anatolia and The Rest of Turkey

As I mentioned before, I set the synthetic Eastern and Southeastern Anatolia as the convex combination of the provinces in the donor pool that most closely resembled treated provinces. The result is displayed in Table 2, which shows the differences between Synthetic Eastern and Southeastern Anatolia and actual Eastern and Southeastern Anatolia. I diverge the all period into the six periods in order to see the impact of terrorism clearly.

After the outbreak of The PKK Terrorism, the per capita real GDP starts to differ noticeably. In the most intense years of Terrorist Activity, the difference in the per capita real GDP becomes the maximum 568.833. As I mentioned before that the longest cease fire for the terrorist activity was between 2000-2004 and it causes the difference in per capita real GDP to decrease substantially. In the course of time, the per capita real GDP gap between the actual Eastern and Southeastern Anatolia and its synthetic counterpart continues to dwindle. While the intensity of terrorism decreases, in response to this, the per capita real GDP gap also tails off.

Figure 6 displays the per capita real GDP for Eastern and Southeastern Anatolia and its synthetic counterpart during the period 1975-2010. The synthetic GDP trajectory is constructed by using convex combination of provinces in the donor pool that closely re-

sembled Eastern and Southeastern Anatolia before the outbreak of terrorism (see table 1). Notice that per capita real GDP for Eastern and Southeastern Anatolia and its synthetic counterpart very closely track until the intervention period which is the first sign of the synthetic control method. This suggests that the synthetic Eastern and Southeastern Anatolia provides the good fir for the pre terrorism period.

First years of the intervention do not affect the trends, but in 1990 trajectories began to diverge and the synthetic counterpart of Eastern and Southeastern Anatolia remains above in all the periods. This might be an explanation of the cost of PKK terrorism.
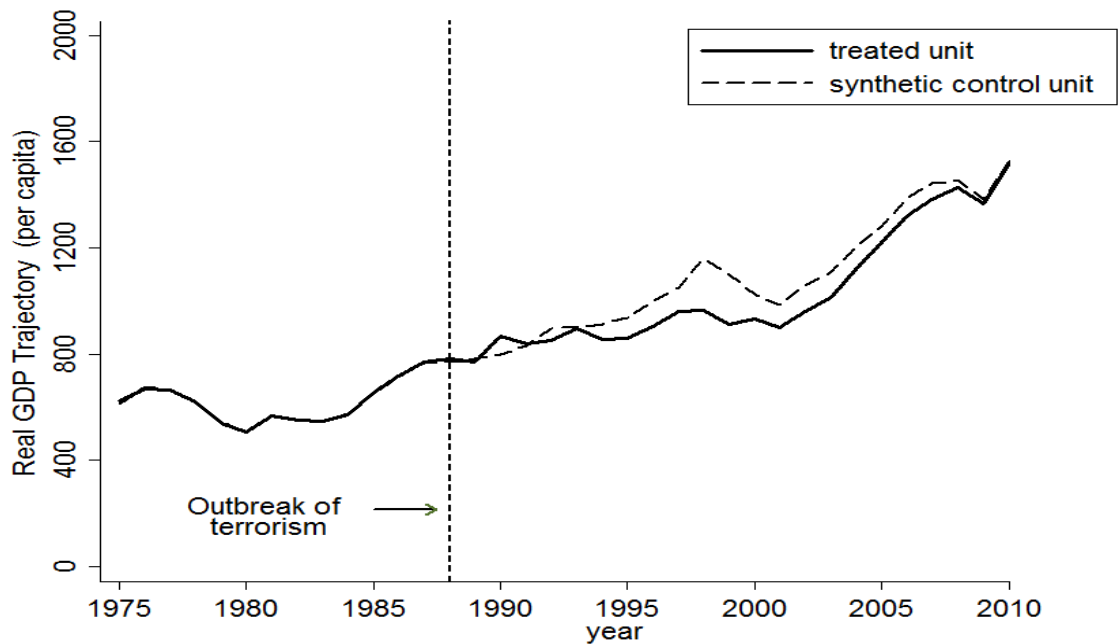

Figure 6: Trends in per capita Real GDP for Eastern and Southeastern Anatolia and its Synthetic Counterpart

Especially the most intense years for the terrorist activity between 1990-1994, trends diverge more respect to the number of casualties. As I mentioned before that, the longest cease fire in the conflict was in 2000-2004 and due to accumulation of per capita real GDP, lines track each other closely. In the case of economy, the per capita real GDP for Eastern and Southeastern Anatolia recovers the economic performance in the period of the cease fire.

I reveal that after the outbreak of terrorism the annual real per capita GDP on average in Eastern and Southeastern Anatolia declined by about 5.7 percent relative to its synthetic counterpart without terrorism in the period 1975-2010.

Figure 7 plots the effect of the terrorism, that is, yearly gaps in per capita real GDP between Eastern and Southeastern Anatolia and its synthetic counterpart. As it is seen, the terrorism activity had a large effect on per capita real GDP after the intervention. Our result suggests that for the entire 1988-2010 period the annual per capita real GDP on

average in Eastern and Southeastern Anatolia is declined almost 5.7 percent respect to its synthetic counterpart. The longest cease fire affects the per capita real GDP gap positively and helps to its decrease.
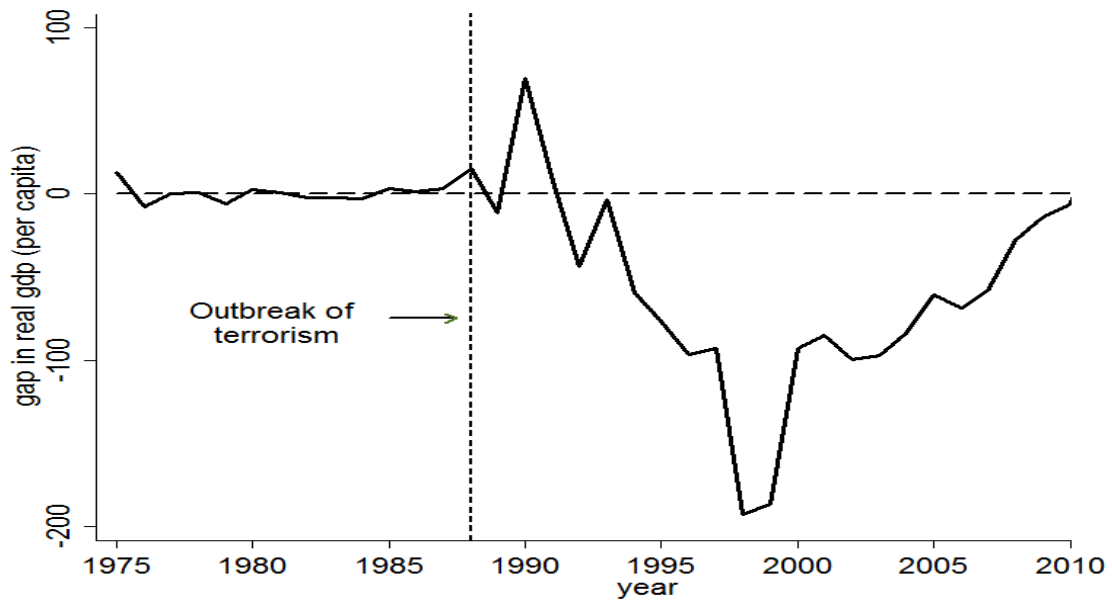

Figure 7: Per capita Real GDP Gap between Eastern and Southeastern Anatolia and its Synthetic Counterpart

Period	Δpc GDP	ΔGDP (billions)
1988-1991	80.3	3.2
1992-1995	-183.5	-7.7
1996-1999	-568.8	-24.8
2000-2003	-374.8	-21.4
2004-2007	-271.4	-18.7
2007-2010	-106.5	-7.5

Table 2: Δpc GDP; Loss in per capita real GDP between actual Eastern and Southeastern Anatolia and Synthetic Eastern and Southeastern Anatolia, ΔGDP; Loss in total GDP between Actual Eastern and Southeastern Anatolia and Synthetic Eastern and Southeastern Anatolia.

5.1   Inference about the impact of PKK Terrorism

In order to ensure the significance of our result, I pose a series of robustness checks known as in-space placebo test and in-time placebo test. First, I run in-space placebo test by applying the synthetic control method to provinces that did not expose a large scale of terrorism during the sample period of our study.

Second, I run in-time placebo test by changing the intervention year as if happens before. In the case of in-time placebo test, I pose the treatment year before 1988 in order to see whether the results differ according to actual one.

If the placebo studies create a large effect as much as our result, then our estimation does not provide significant evidence of a negative effect of PKK terrorism. I apply the synthetic control method to every other province in the donor pool which were not directly exposed to terrorism. In each iteration I reassign in our data the outbreak of terrorism intervention to one of the 43 control provinces shifting Eastern and Southeastern Anatolia to the donor pool. That is, I proceed as if one of the province in the donor pool would have a large effect of outbreak of terrorism in 1988. I then compute the effect of each placebo run and the results suggest that estimated gaps for the provinces do not have a large effect of impact of PKK terrorism.

Figure 8 plots the result for placebo test. The gray lines represent the estimated per capita real GDP gap of each 43 provinces in the donor pool. The blue solid line represents the estimated per capita real GDP gap for Eastern and Southeastern Anatolia for the period 1975-2010.

As we can see that the estimated gap of Eastern and Southeastern Anatolia tracks in zero gap line before the intervention which is one of the important condition for Synthetic Control Method. That is to say, the per capita real GDP provides a good fit in the pre terrorism period.
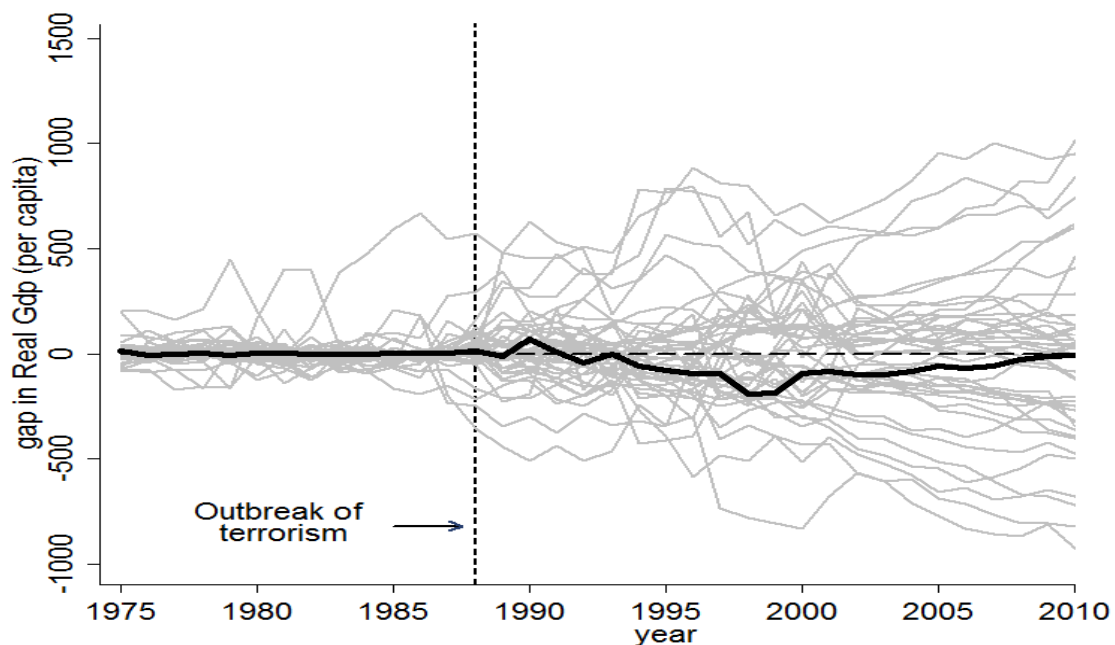

Figure 8: Per capita Real GDP Gap for Eastern and Southeastern Anatolia and Placebo Gaps in all 43 Control Provinces

If the synthetic Eastern and Southeastern Anatolia had failed to fit per capita real GDP for the real Eastern and Southeastern Anatolia before the intervention, our estimation would be biased.

Figure 9 discards the provinces that had a pre-terrorism Mean Square Prediction Error (measures the magnitude of the gap in the outcome variable of interest between each country and its synthetic counterpart) of more than 20 times the MSPE of Eastern and Southeastern Anatolia.
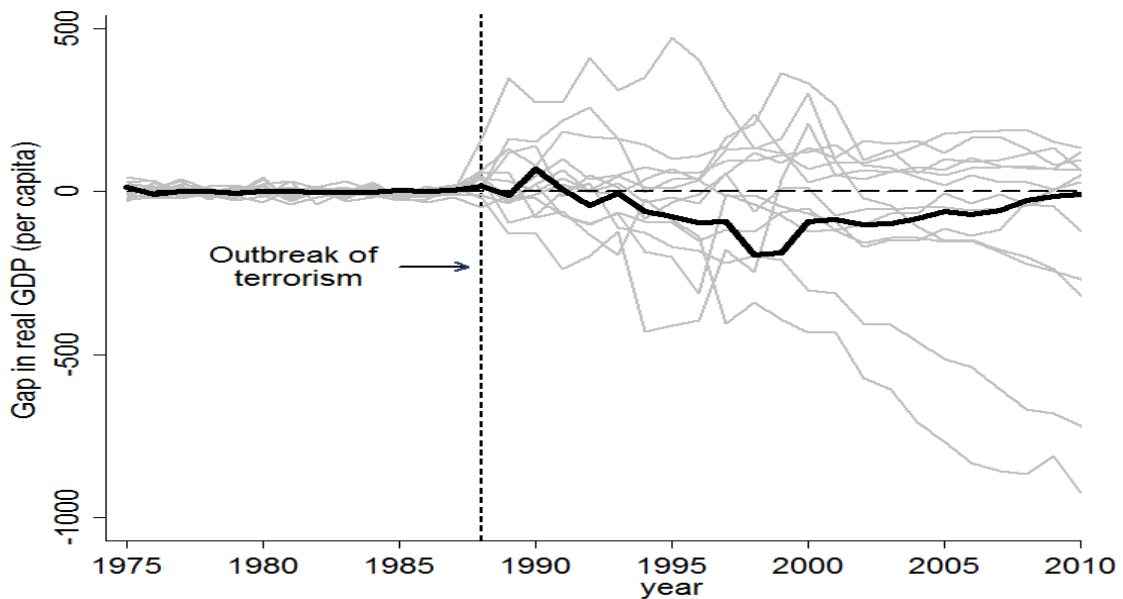

Figure 9: Per capita Real GDP Gap for Eastern and Southeastern Anatolia and Placebo Gaps in 32 Control Provinces (discard the provinces with the pre-terrorism MSPE twenty times higher

In order to see the result clearly, I run placebo test once with the pre-MSPE five times more than Eastern and Southeastern Anatolia's.

Figure 10 plots placebo experiment with discarding all provinces that had the pre-terrorism period MSPE of more than five times the MSPE of Eastern and Southeastern Anatolia. This makes a big difference in the placebo run by remaining 2 provinces in the donor pool.

However other provinces fail to track in zero gap line in the pre terrorism period which provides most unusual line for Eastern and Southeastern Anatolia in the placebo experiment.
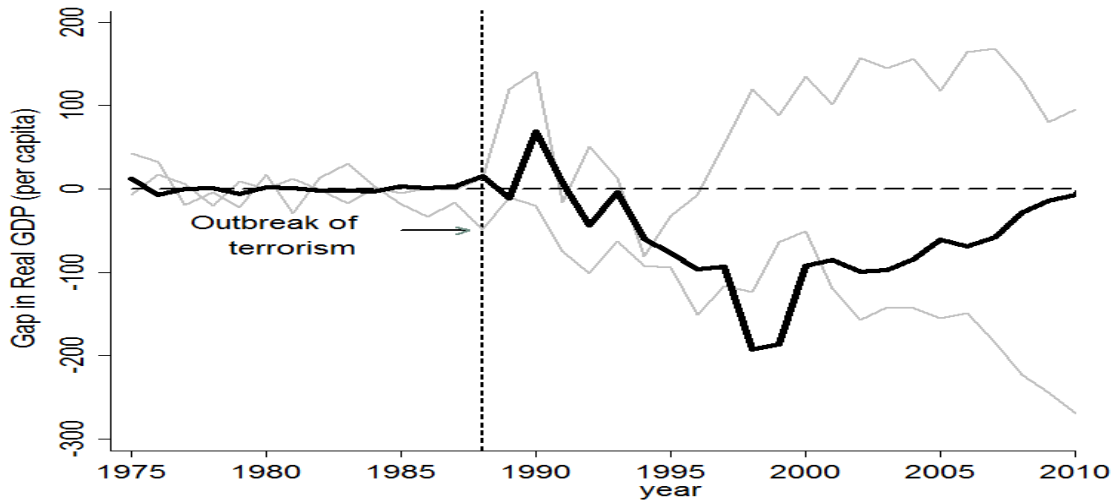
Figure 10: Per capita Real GDP Gap for Eastern and Southeastern Anatolia and Placebo Gaps in 2 Control Provinces (discard the provinces with the pre-terrorism MSPE five times higher)

Figure 11 represents the last placebo experiment with discarding all provinces that had the pre-terrorism period MSPE of more than two times the MSPE of Eastern and Southeastern Anatolia in order to measure the most closer fits to the actual treated unit.

In the figure, the gap for Eastern and southeastern Anatolia clearly stands out than other which only remain single unit. Additionally, while the estimated gap of Eastern and Southeastern Anatolia tracks in the zero gap line, another one tracks a complicated trend a far away from the zero gap line in the pre-terrorism period which departs from the rule of synthetic control method. As I said before that the per capita real GDP gap trend by 2000s decrease until 2010.
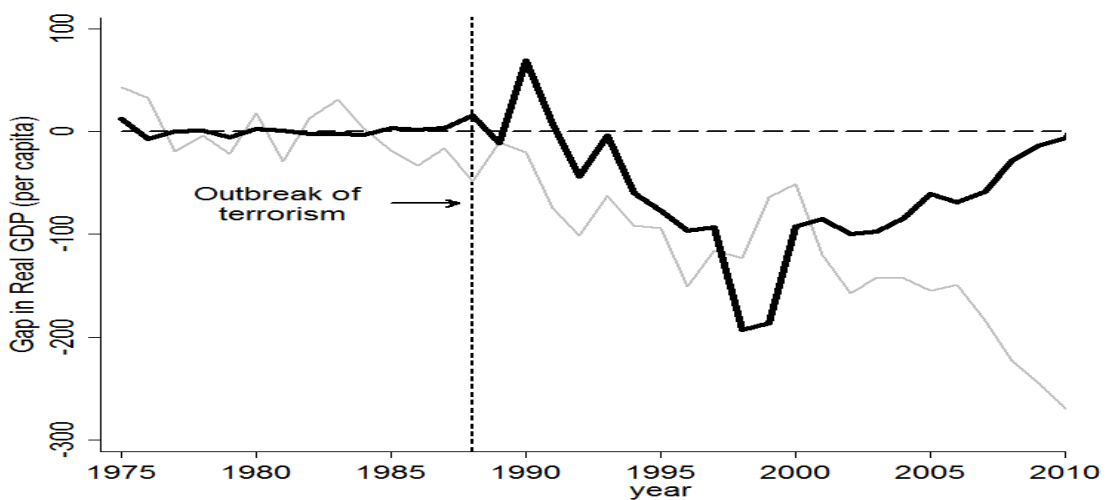

Figure 11: Per capita Real GDP Gap for Eastern and Southeastern Anatolia and Placebo Gaps in 1 Control Provinces (discard the provinces with the pre-terrorism MSPE two times higher

Our in-space place test has led us to conclude that separatist terrorism imposes a significant negative effect on per capita real GDP. The estimated GDP gap of Eastern and Southeastern Anatolia track very close to zero in the pre-terrorism period and also stands out in the post-terrorism period. Otherwise, I would conclude that PKK terrorism does not have any sizeable impact on per capita real GDP of the treated unit. In all the in-space placebo runs, the estimated gap widens and stands out in the post-terrorism period. In short, the in-space placebo tests provide that the large estimated effect of PKK terrorism relative to the distribution of placebo effects.

The estimated effect of terrorism for the treated unit is evaluated by calculating the ratio of post/pre-terrorism MSPE. In our distribution only 4 provinces remain outside of the treated unit and this provide the statistical p-value as 4/44= 0.09 which is significant at 10 percentage. (see figure 12)
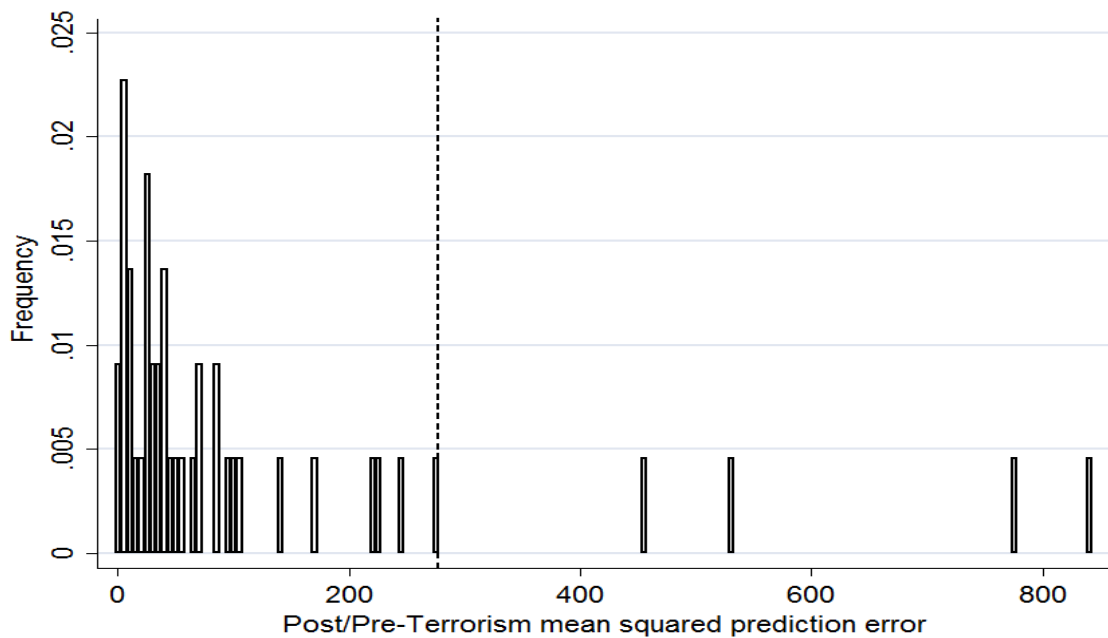

Figure 12: Ratio of post-terrorism MSPE and pre-terrorism MSPE : Eastern and Southeastern Anatolia and 43 control provinces.

Finally, I examine two more additional sensitivity tests, apart from the in-space placebo test, described in Abadie, Diamond and Hainmuller (2015). The first is the "in-time placebo" test, in which I reassign the treatment to occur during the pre-treatment period. A placebo estimate differing significantly from the actual pre-treatment path would call the model's predictive power into question. I conduct an in-time placebo test, where I assigned the treatment to the year 1980, roughly in the middle of our 1975-1988 pre-treatment period.

The sample period for this placebo model must end by the year that the actual treatment occurred (1988) to avoid capturing its effect. I use the same predictors and years. Our synthetic Eastern and Southeastern Anatolia for a 1980 placebo treatment closely follows the path of actual Eastern and Southeastern Anatolia during the pre-treatment pe-

riod. (see figure 12)

After the actual intervention (1988), trends start to diverge and follow the same result as before until 2010. As I mentioned before that after 2000 period trajectories begin to get close to each other due to decrease on terrorist activity until 2010. In other words, the per capita loss begin to decrease after 2000.
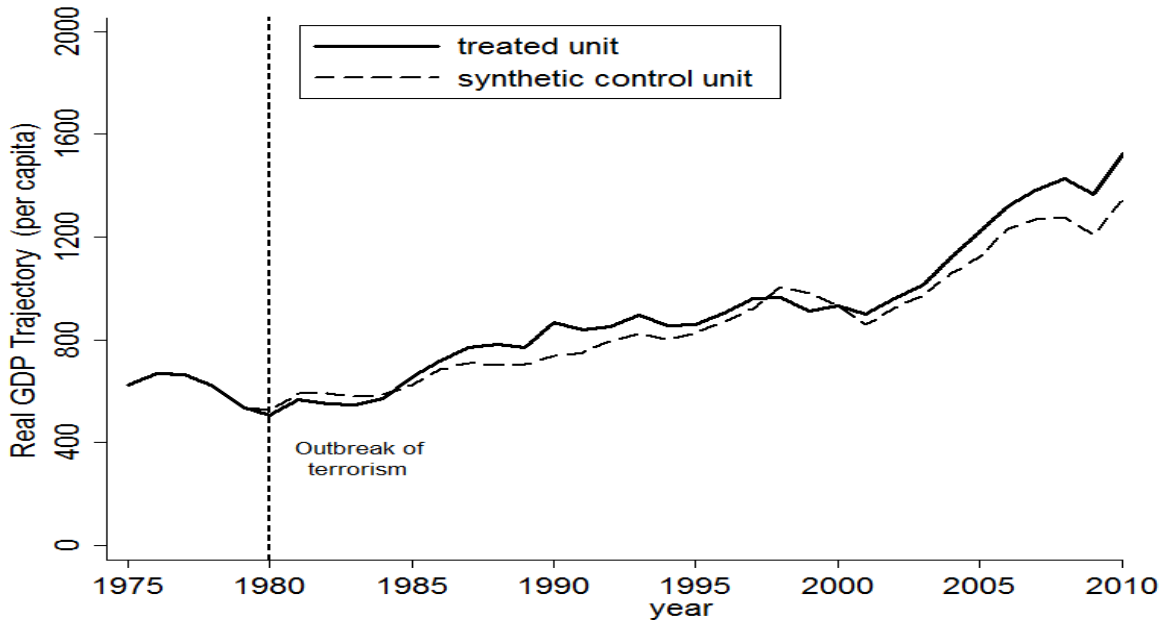

Figure 13: In-time placebo test

A second sensitivity test is the leave-one-out test. Here, I iterate over the model to leave out one selected donor province each time to assess whether one of the donor provinces is driving the result. Figure 13 represents the leave-one-out distribution with the synthetic and treated unit. The leave one provinces constructed by the provinces which had positive weights respectively Ankara, Artvin, Çankırı, Giresun, Gümüşhane, Muğla, Sivas and Tokat.

The black solid line represents the actual Eastern and Southeastern Anatolia, the black dashed line represents the synthetic Eastern and Southeastern Anatolia and gray lines represent the leave one out estimations.

The leave-one-out analysis provides that our main result shown as before is fairly robust to the exclusion of any particular province from the sample. The average of all eight leave-one-out estimates of the synthetic Eastern and Southeastern Anatolia are 0.03 percent higher than the actual Eastern and Southeastern Anatolia and 0.1 percent higher than the original synthetic Eastern and Southeastern Anatolia (black dashed line) in the pre-terrorism period. Most importantly, the average of all leave-one-out estimates of the synthetic control are only 0.08 percent higher on average, relative to our original synthetic control estimate in the post-terrorism period. This suggests that the leave-one-out estimates are extremely robust to province exclusion.
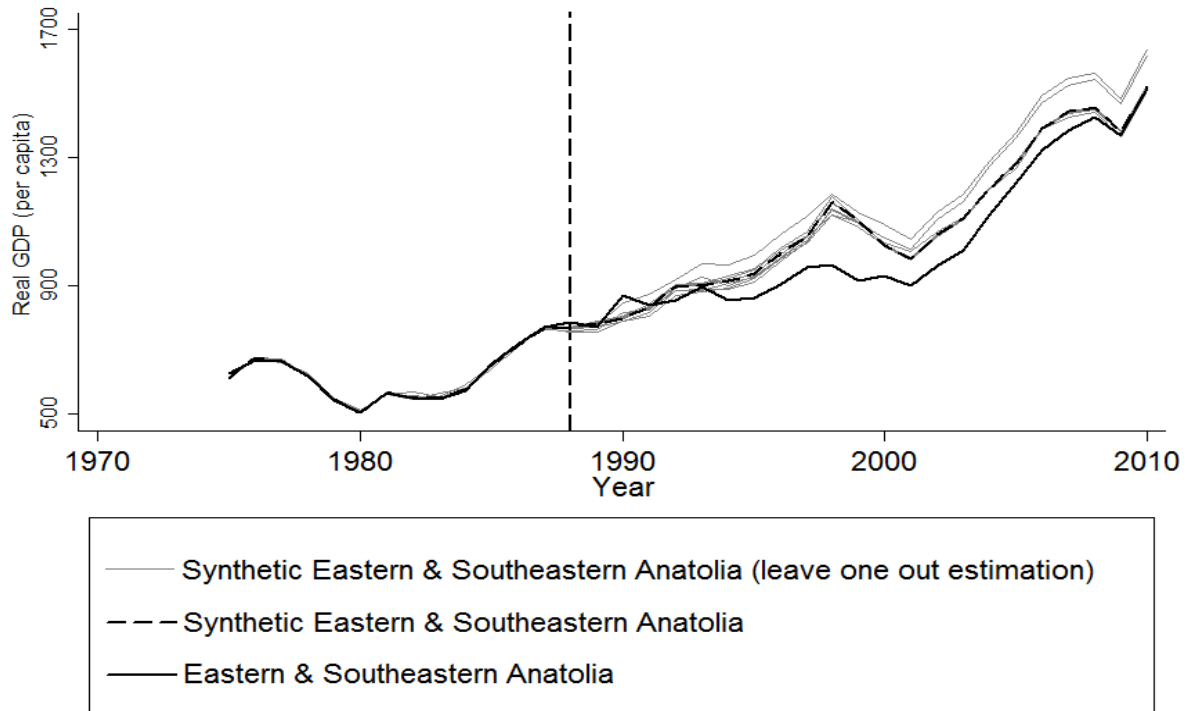
Figure 14: Leave-one-out Analysis

Table 3 represents two provinces which have the maximum and minimum effect of our result. Both losses are calculated when Giresun and Tokat leaved out. As I mentioned before that I diverge the our sample into the six parts in order to see difference and loss clearly.

Leaving-out Giresun has a maximum effect for driving our result and leaving-out Tokat has minimum effect. Both losses in per capita terms start to decrease after the period of 2000 due to decreasing of terrorist activities and go on until the end of the sample. The most importantly, our previous result is in the middle of two provinces and this suggest that our leave-one-out analysis fairly robust to our main conclusion.

Period	Leaving out Giresun (maximum effect) Δpc GDP	Leaving out Tokat (minimum effect) Δpc GDP
1988-1991	-8.8	157.1
1992-1995	-381.9	-98.5
1996-1999	-746	-473.3
2000-2003	-646.6	-361
2004-2007	-661.6	-258.4
2007-2010	-376.1	-37.6

Table 3: Δpc GDP; Loss in per capita real GDP between actual Eastern and Southeastern Anatolia and Synthetic Eastern and Southeastern Anatolia.

Period	Leaving out Giresun (maximum effect) ΔGDP (billion)	Leaving out Tokat (minimum effect) ΔGDP (billion)
1988-1991	-0.3	6.2
1992-1995	-16.1	-42
1996-1999	-32.5	-20.67
2000-2003	-37	-20.61
2004-2007	-45.8	-17.8
2007-2010	-27.2	-2.7

Table 4: ΔGDP; Loss in total GDP between actual Eastern and Southeastern Anatolia and Synthetic Eastern and Southeastern Anatolia.

Table 4 demonstrates losses in total GDP when Giresun and Tokat leaved out. Both losses on aggregate terms start to decrease after the period of 2000 due to decreasing of terrorist activities and go on until the end of the sample.

Another way to evaluate the Eastern and Southeastern Anatolia gap relative to the gaps obtained from the placebo runs is to look at the distribution of the ratios of post/pre-terrorism MSPE. Our confidence that a sizeable synthetic control estimate reflects the impact of terrorism would be severely undermined if the estimated gap fell inside the distribution of placebo gaps. In other words, a significant causal effect of separatist terrorism on the treated unit requires that the estimated gap should be unusually large relative to the placebo effects.

6   Conslusions

Comparative case study research has broad potential in the social sciences. However, the empirical implementation of comparative studies is plagued by inferential challenges and ambiguity about the choice of valid control groups. In this paper, I employ the use of data-driven procedures to select the synthetic comparison units in comparative case studies.

I investigate the applicability of the synthetic control method by studying the effect of the PKK terrorism in Turkey that Eastern and Southeastern Anatolia mostly started to exposed in 1988. I find that an average gap of 5.7 percentage between the actual per capita real GDP of Eastern and Southeastern Anatolia and the per capita real GDP of synthetic Eastern and Southeastern Anatolia without terrorism in the period of 1975-2010.

In order to ensure the sensitivity of our results, I run several placebo experiments in-time placebo test and in-space placebo test respectively. I provide several different versions of figure 8, each version excluding provinces beyond a certain level of pre-terrorism MSPE. In addition, I extend the sensitivity tests with leave-one-out analysis, in order to

see which our result is driven by any particular provinces.

The leave-one-out analysis provides that our main result shown as before is fairly robust to the exclusion of any particular province from the sample. The average of all eight leave-one-out estimates of the synthetic Eastern and Southeastern Anatolia are 0.03 percent higher than the actual Eastern and Southeastern Anatolia and 0.1 percent higher than the original synthetic Eastern and Southeastern Anatolia in the pre-terrorism period. Most importantly, the average of all leave-one-out estimates of the synthetic control are only 0.08 percent higher on average, relative to our original synthetic control estimate in the post-terrorism period.

The estimate impact of PKK terrorism on economic progress for Eastern and Southeastern Anatolia is given by the difference between the actual and the synthetic per capita GDP. The real GDP gap in Eastern and Southeastern Anatolia closely tracks in the zero-gap line in the pre-terrorism period (first sign of SCM) and starts to diverge after being exposed to terrorism. The gap between the actual per capita GDP and its synthetic counterpart increases with intensity of terrorism until 2001. By decreasing the intensity of terrorist activity after 2001, the estimated gap between the actual Eastern and Southeastern Anatolia and its synthetic counterpart also begins to decrease respectively.

The evidence from this study suggests that PKK terrorism has a negative impact on per capita real GDP of Eastern and Southeastern Anatolia thus on economic development of Turkey. Findings of this study indicate that in the post-terrorism period extending until 2010, annual real per capita GDP on average in Eastern and Southeastern Anatolia declined by about 5.7 percent relative to its synthetic counterpart without terrorism in the period 1975-2010.

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