

# Measuring the Economic Cost of the 2007/08 Post-Election Violence in Kenya

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## **Abstract**

In this paper we measure the economic cost that the 2007 post-election violence had in the Kenyan economy. Little research has been done in terms of how conflicts impact different African countries. A synthetic control method to comparative case studies is used to construct a "synthetic" control region based on a weighted combination of African countries which resembles many relevant economic characteristics in Kenya without the post-election violence of 2007. The economic evolution of this counterpart, Kenya without post electoral violence, is compared to the actual experience of Kenya. It is found that over the period 2007-2011, per capita GDP was reduced by an average of 70 USD per year, which amounts to be approximately 5 percent of the 2007 baseline level. In 2009, per capita GDP in the actual Kenya is estimated to be about 6 percent lower than in its synthetic counterpart.

# 1 Introduction

In December 1991 the Kenyan Constitution changed allowing for the first time multi-party democracy. Since then, Kenya has had four general elections: 1992, 1997, 2002 and 2007; and all of them had a common factor of violence. In this paper we focus on the last election, 2007, where official figures stated that in the ensuring days of the election over 1200 people were killed, there was massive destruction of property in some areas, several hundred thousand Kenyans were displaced from their communities and data from the Nairobi Women's Hospital – Gender Recovery Centre showed that there were over 356 cases of sexual violence.<sup>1</sup> During this violent period at the end of 2007 and beginning of 2008 Kenya had a political, economic and humanitarian crisis.

On December 27th 2007, Mwai Kibaki who was the incumbent president of the Party of National Unit and from the Kikuyu ethnic group was declared the winner of the presidential elections despite the opposition leader Raila Odinga of the Orange Democratic Movement and from the Luo ethnic group alleged electoral manipulation. This was confirmed by international observers; in fact, an exit poll commissioned by the US in July 2008 revealed that Odinga won the polls by a 6-point margin over the President Kibaki.<sup>2</sup>

Roberts (2009) studies the conflict analysis of the 2007 post-election violence in Kenya and states that "over the span of three decades, amendments to the constitution were made to systematically erode these balances in favor of strengthening presidential powers." In 2005 there was a constitutional referendum, Mwai Kibaki that also won the 2002 elections promised a new constitution in "a hundred days" during his 2002 campaign. A draft Constitution was produced in March 2004 (Bomas Draft), but its terms, notably those reducing the executive powers of the Presidency, turn out unacceptable to the Government. Key amendments were made to this draft Constitution and some felt that it has been illegitimately modified, for example, to preserve wide powers for the President.

There is a mood among Kenyans, especially youth, that major reforms should be implemented in the governance of Kenya. Some of them would be addressing the deep-rooted corrup-

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<sup>1</sup>Report from OHCHR Fact-finding Mission to Kenya, 6-28 February 2008.

<sup>2</sup>See Gibson and Long (2009) for more details on the electoral results.

tion, delegation of political and administrative power, and a wider constitutional reform.

The major political issue is ethnicity, which is subterranean most of the time. The long term causes are attributed to the colonial legacy; Kenyan society was ethnicized as part of a “divide and rule” strategy which polarized the various ethnic groups in Kenya. This contributed to a lack of balance in regional development, which continues nowadays. Early political parties in Kenya against colonial establishments were basically ‘distinct ethnic unions’, because no single ethnic group had sufficient support to win elections alone. Kenya inherited from the colonialist scarce national resources, inadequate infrastructure, among others. Land is yet another source of ethnic conflicts in Kenya; it has remained a delicate economic and political issue.

Those political alliances broad support and increase the likelihood of gaining political and economic power. Ethnicity became the vehicle through which the preservation of power and resources could be achieved. As a result, a common political voice as actors of one nation-state called Kenya was not possible. Currently ethnicity of key candidates remains the key mobiliser of political support; there is a strong perception that having a ‘relative’ in State House could substantially increase the access to the national cake.

According to Gallup<sup>3</sup> a majority of Kenyans (70%) thought the election was dishonest, this though vary through ethnic groups. Five ethnic groups in Kenya represent more than two-thirds of the national population (Kikuyu, 19%; Kalenjin, 15%; Luo, 13%; Luhya, 12%; and Kamba, 9%), only the Kikuyu ethnic group are the ones whose majority thought (67%) that the election was honest. In the remaining ethnic groups the percentage of respondents believing the election was honest is very small, below 15% in all cases.

Political instability has an adverse effect on economic growth, as stated in Alesina et al. (1996). However, it is difficult to know how countries would have evolved in the absence of political instability. Abadie and Gardeazabal (2003) were the first to investigate the economic impact of conflict and develop a method, the synthetic control for comparative case studies, to measure the economic evolution that the Basque Country would have had in the absence of terrorism and compare it to the actual experience.

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<sup>3</sup>Gallup provides data-driven news based on U.S. and world polls, daily tracking and public opinion research, <http://www.gallup.com/poll/111622/kenya-most-ethnic-groups-distrust-2007-election.aspx>

In this paper we measure the economic cost that the 2007 post-election violence had in the Kenyan economy. Little research has been done in terms of how conflicts impact different African countries; the focus has been developed economies. We employ the synthetic control method (Abadie and Gardeazabal, 2003; Abadie, Diamond, and Hainmueller, 2010) to construct a "synthetic" Kenya based on a weighted combination of other African countries that best resemble the characteristics of the real Kenya without the post-election violence of 2007. A simple comparison between Kenya and its synthetic counterpart during the years after the election took place may not only reflect the impact of the post-election violence, but also other pre-election differences which affected the economic growth. To address this problem we compare the economic evolution of Kenya during the post-election violence era with that of a weighted combination of other African countries chosen to best resemble the economic characteristics of Kenya before the election. It is obtained that the 2007 post-election violence had a negative influence on per capita GDP, actually in 2009, per capita GDP in the actual Kenya was estimated to be about 6 percent lower than in its synthetic counterpart.

The rest of the paper is organized as follows. In section 2 a review of the literature is provided. In section 3 the main ideas behind the synthetic control approach to comparative case studies of aggregate events are explained, and this method is applied to estimate the effect of the post-election violence in Kenya. In the same section we also presented the data and some falsification exercises. Section 4 concludes.

## **2 Literature Review**

A related literature has studied the effect of terrorism and conflict on different economic variables. Gardeazabal (2010) reviews the methods for measuring the economic cost of conflict. They are: cost accounting, cross-section methods, time series methods, panel data methods, gravity models, event studies, natural experiments and comparative case studies. The one we use to investigate the economic cost of the post-election violence is a comparative case study, and it has been used to study the effect of events or policy measures on aggregate units such as regions or countries. The goal is to estimate the evolution of outcomes for a unit affected by an event or intervention and to compare it with the evolution of a control group.

Employing other methods, Enders and Olson (2012) used the cost accounting method; they made a survey of the literature on the costs of terrorism. They describe different economic costs associated with terrorism, which main groups are indirect and direct costs; they also studied the different sectorial responses to terrorism.

Alesina et al. (1996) investigated a sample of 113 countries, for the period 1950-1982, looking at the relationship between political instability and per capita GDP growth. Their main finding is that political instability reduces growth, that is, growth for countries with a high propensity of government collapse is significantly lower.

The closest paper to ours in terms of subject is the one by Dimitri (2011). He also measures the economic cost of the 2007-2008 election crisis in Kenya. He creates a proximity control with a linear combination of countries with a similar capabilities/exports structure to Kenya. The countries used are: Guatemala, Tanzania, Jordan, Nepal and Uganda. Dimitri (2011) estimates that Kenya's election crisis was 3.7% of GDP by 2009. The main difference with our paper is the methodology used, as we use the synthetic method for comparative case studies and he estimates the economic cost of the elections by a linear combination of countries. He looks at the structure of capabilities/exports to select that linear combination while we use a group of economic growth indicators.

There are other studies that have also used the synthetic control method for comparative case studies. In order to study the impact that the Basque clandestine terrorist organization ETA had on the Basque economy, Abadie and Gardeazabal (2003) constructed a synthetic control region with other Spanish regions that best reproduced the Basque country in the absence of terrorism. The optimal weights were 0.8508 and 0.1492 for Catalonia and Madrid respectively. It was estimated that real Basque country's per capita GDP decline about 10 percentage points compared to the synthetic Basque country.

Abadie, Diamond, and Hainmueller (2010) used the same methodology to study the effects of California's tobacco control program called Proposition 99. It was implemented in California in 1988; they estimated that, by the year 2000, annual per-capita cigarette sales in California were about 26 packs lower than what it would have been in the absence of the proposition. They demonstrated that for the entire 1989-2000 period, cigarette consumption in California had a

decline of approximately 25 percent compared to its synthetic control region.

Abadie, Diamond, and Hainmueller (2012) applied the synthetic control method to estimate the effect on per capita GDP in West Germany German after the reunification of 1990. They constructed a synthetic West Germany using a convex combination of other advanced industrialized countries that best resembled the values of economic growth predictors prior to the reunification. They estimated that the effect of reunification (by comparing the actual and its counterfactual trend) in per capita GDP for West Germany and found that over the period 1990-2003 it was reduced on average 1600 USD per year, which is about 8 percent of the 1990 baseline level.

### 3 Synthetic Control Method for Comparative Case Studies

The aim of this section is to assess the impact that violence has had on economic growth for Kenya. First it is useful to have in mind the definition of a synthetic control method and its use:

"The synthetic control method allows for effect estimation in settings where a single unit (a state, country, firm, etc.) is exposed to an event or intervention. It provides a data-driven procedure to construct synthetic control units based on a weighted combination of comparison units that approximates the characteristics of the unit that is exposed to the intervention. A combination of comparison units often provides a better comparison for the unit exposed to the intervention than any comparison unit alone".<sup>4</sup>

We use a combination of other African countries to construct a synthetic control country that best reproduces relevant economic characteristics of Kenya before the post-election violence of 2007. The economic evolution of this synthetic Kenya without post-election violence is compared to the actual experience of Kenya. Table 1, in columns (1) and (3), contains values of some variables associated with growth potential, for Kenya and the African control countries, for the years prior to the election of 2007. A simple comparison between Kenya and its synthetic counterpart during the years after the election took place may not only reflect the impact of the

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<sup>4</sup>Companion software developed by Abadie, Diamond and Hainmueller. Massachusetts Institute of Technology, Software Packages, <http://www.mit.edu/~jhainm/software.htm>

post-election violence, but also other pre-election differences which affected the economic growth. To address this problem we compare the economic evolution of Kenya during the post-election violence era with that of a weighted combination of other African countries chosen to best resemble the economic characteristics of Kenya before the election. That weighted combination of African countries is called "synthetic" Kenya without post-election violence, against which we compare the actual Kenya with post-election violence.

Suppose you observe  $J + 1$  countries, where  $j = 1$  is the country exposed to the intervention, in this case Kenya to the post-election violence of 2007, and  $j = 2$  to  $j = J + 1$  is the donor pool, the set of potential control countries (21 African countries other than Kenya). Let  $W$  be a  $(J \times 1)$  vector of non-negative weights that sum up to one,  $W = (w_1, \dots, w_{j+1})'$ , with  $0 < w_j < 1$  for  $j = 2, \dots, J$  and  $w_2 + \dots + w_{j+1} = 1$ ; summing up to one provides a safeguard against extrapolation. The scalar  $w_j$  ( $j = 2, \dots, J + 1$ ) represents the weight of region  $j$  in the synthetic Kenya. The sample is a longitudinal data set where all units are observed for the same time periods,  $t = 1, \dots, T$ . Let  $T_0$  being the pre-election period and  $T_1 = T - T_0$  the post-election period. The objective is to observe and measure the event of interest, in this case the 2007 election, on the post-election outcome. Each particular value for  $W$  represents a particular weighted average of control countries; each different value produces a different synthetic Kenya.

The weights are chosen so the synthetic Kenya best reproduces the characteristics of the actual one before the post-election violence. Let  $X_1$  be a  $(K \times 1)$  vector of pre-intervention values of  $K$  economic growth predictors for Kenya (i.e., those in Table 1, column 1). Let  $X_0$  be the  $(K \times J)$  matrix which contains the values of these same variables for the  $J$  possible donor pool countries. The differences between the pre-intervention values of Kenya, and its synthetic control is given by the vector  $X_1 - X_0W$  and  $W$  is selected ( $W^*$ ) so it minimizes the size of this difference.

Let  $V$  be some  $(K \times K)$  symmetric and positive semi definite matrix, which values of the diagonal reflect the relative importance of the different growth predictors. The optimal choice of  $W$  assigns weights which reflect the relative importance of the variables in  $X_0$  and  $X_1$  to minimize the mean square error of the synthetic control estimator<sup>5</sup>. Abadie and Gardeazabal (2003) choose

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<sup>5</sup>That is, the expectation of  $(Y_1 - Y_0W)'(Y_1 - Y_0W)$ .

$V$  such that the real per capita GDP path for the Basque Country before terrorism best reproduces the synthetic Basque Country<sup>6</sup>. Abadie and Gardeazabal (2003) and Abadie, Diamond and Hainmueller (2010) choose the vector of weights  $W^*$  to minimize  $(X_1 - X_0W)'V(X_1 - X_0W)$  subject to  $0 < w_j < 1$  for  $j = 2, \dots, J$  and  $w_2 + \dots + w_{j+1} = 1$ .

Let  $Y_{jt}$  be the outcome unit  $j$  at time  $t$ . In addition, let  $Y_1$  be a  $(T_1 \times 1)$  vector of post-election outcome, whose elements are the values of real per capita GDP for Kenya. That is,  $Y_1 = (Y_{1T_0+1}, \dots, Y_{1T})$ . Let  $Y_0$  be a  $(T_1 \times J)$  matrix of post-election outcomes which contains the values of the same variables for the potential donor pool countries. The goal is to approximate the per capita GDP path, PPP (2005 international dollars), that Kenya would have experienced without the violence that experimented after the 2007 elections. The synthetic control estimator of the effect of the post-election violence is given by the difference between the post-event outcomes of Kenya and its synthetic control (which is not exposed to the conflict)  $Y_1 - Y_0W^*$ . For a post-election period  $t$  (with  $t \geq T_0$ ) the synthetic control estimator of the effect of the post-election violence is given (Abadie, Diamond and Hainmueller, 2012) by the comparison between the outcome for the treated unit and the outcome for the synthetic control at that period:

$$Y_{1t} - \sum_{j=2}^{J+1} w_j^* Y_{jt}.$$

As explained in Abadie, Diamond, and Hainmueller (2010), as the choice of a synthetic control does not need access to post-intervention outcomes, allows researchers remain blind without knowing how each decision will affect the conclusions of their studies. Also, in contrast with other traditional regression methods, which typically rely on asymptotic limit theorems for inference, having a small number of regions to construct the synthetic control does not invalidate the inferential methods. They also propose methods so it is possible to produce informative inference regardless of the number of available comparison units, the number of available time periods, and whether the data are individual (micro) or aggregate (macro).

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<sup>6</sup>See Abadie and Gardeazabal (2003) for additional details on the election of the matrix  $V$ .

## 4 Measuring the economic cost of conflict

### 4.1 Data and Sample

Annual country panel data for the period 2002-2011 are employed in this work. The elections took place in December 2007, which gives 6 years of pre-election data. First we included data from 1991, which was the first year that multi-party democracy was allowed. We realized that violence and negative economic growth was common in all elections, therefore we have three periods (1992, 1997, 2002) since 1991 where there is a negative impact due to an election taking place, including data from 1991 was distorting the synthetic region to be accurate, which is why the sample period begins in 2002. It ends in 2011 because is the latest availability of real GDP per capita.

The outcome variable used is GDP per capita, PPP (2005 international dollars) in country  $j$  at time  $t$ . We obtained this data from the World Development Indicators and Global Development Finance<sup>7</sup> of the World Bank. For the pre-election characteristics in  $X_{jt}$  the set of economic growth predictors are: per capita GDP, population density, FDI inflow (%GDP), agriculture value added (%GDP), services value added (%GDP), industry value added (%GDP), energy production (kt of oil equivalent), inflation rate, exports and imports (%GDP). We also included the life expectancy at birth, total (years). It is an important predictor when accounting for African countries, life expectancy is a measure of human capital related to the health of the population. Artadi and Sala-i-Martin (2003) analyse some economic growth determinants and compare how Africa would have performed if those determinants had taken OECD values. They show that if Africa had had a life expectancy similar to the OECD, its annual growth rate would have been 2,07 percentage points larger.

The synthetic Kenya was created from different African countries, choosing the optimal weights so that the synthetic counterpart best reproduces the real one in terms of values of a set of predictors of economic growth in Kenya before the elections in 2007. As referred in Abadie,

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<sup>7</sup>World Development Indicators (WDI) is the primary World Bank database for development data from officially-recognized international sources. Global Development Finance (GDF) provides external debt and financial flows statistics for countries that report public and publicly-guaranteed debt under the World Bank's Debtor Reporting System (DRS).

Diamond and Hainmueller (2010), the set of potential control countries for Kenya is identified as the "donor pool". In Africa there are 54 countries, but regarding the predictors of economic growth, some of them did not have available data. One country (Zimbabwe) did not have the outcome variable available. We also discard 13 countries due to lack of data in one or several economic growth variables: agriculture, industry, services, exports, imports, FDI and inflation.<sup>8</sup> Other 16 countries had no data on energy production.<sup>9</sup> Finally, we discard two more countries (Eritrea and Namibia) due to lack of data on inflation. Our donor pool includes the 21 remaining countries: Algeria, Angola, Benin, Botswana, Cameroon, Congo Dem. Rep., Congo Rep., Cote d'Ivoire, Egypt, Arab Rep., Ethiopia, Gabon, Ghana, Morocco, Mozambique, Senegal, South Africa, Sudan, Tanzania, Togo, Tunisia, Zambia.<sup>10</sup>

## 4.2 Results

As explained before we construct a synthetic Kenya as a convex combination of different countries which resembles many relevant economic characteristics of Kenya before the post-election violence of 2007. The results are displayed in Table 1; it compares pre-election characteristics of the actual Kenya with its synthetic Kenya, as well as a weighted average of the 21 African countries of the donor pool. These figures show how well the weighted combination of control countries reproduces the values of economic predictors for Kenya before the post-election violence. As expected, both, the synthetic and the actual Kenya look comparable, although there are two determinants that cannot be perfectly fitted. In particular, Kenya is, among all donor pool countries, the one with the lowest FDI, therefore a convex combination of other African countries cannot perfectly reproduce it. The other predictor that is not perfectly fitted is energy production, this is because Benin which accounts for 50 percent of the synthetic Kenya has an

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<sup>8</sup>Burundi, Comoroos, Dijibuti, Gambia, Guinea, Guinea-Bissau, Liberia, Mali, Niger, Sao Tome, Sierra Leone, Somalia and South Sudan.

<sup>9</sup>Burkina Faso, Cape Verde, Central African Republic, Chad, Guinea Equatorial, Lesotho, Libya, Madagascar, Malawi, Mauritania, Mauritius, Nigeria, Rwanda, Seychelles, Swaziland and Uganda.

<sup>10</sup>Using other economic growth predictors does not change the preliminary results. For example, including the countries discarded due to lack of data on energy production and withdrawing the variable energy production does not change the results obtained; however it makes the synthetic Kenya less accurate because the weights chosen are from the actual donor pool countries.

energy production of 1688 (kt. of oil equivalent) while the one for the actual Kenya is 13717 (kt. of oil equivalent). As seen in the table, the African donor pool countries do not constitute a suited control group by itself. In particular, the average per capita GDP of all pool countries is almost three times the one of the actual Kenya. Moreover, the average energy production is double for the African countries, and exports and imports are each one about 10 percentage higher than in the real Kenya.

Table 2 displays the weights of each control state in the synthetic Kenya. The weights reported indicate that the economic predictors for Kenya before the post-election violence of 2007 are best reproduced by a combination of Angola, Benin, Ethiopia, Mozambique, Senegal and Zambia. Benin accounts for 50 percent of the synthetic Kenya because all predictors, except energy production, are very similar to the actual Kenya. All other states in the donor pool are assigned zero weights.

Figure 1 displays the per capita GDP evolution of Kenya and its synthetic country for the 2002-2007 period. The synthetic Kenya reproduces almost perfectly the per capita GDP for Kenya during the pre-election period. This figure, combined with the high suitability of the economic predictors (Table 1), suggests that the synthetic Kenya provides a sensible approximation to per capita GDP that would have experienced Kenya in 2007-2011 in the absence of the post-election violence.

The effect of the post-election violence on per capita GDP in Kenya is the difference between the actual Kenya and its synthetic version after the elections of 2007. It is seen that immediately after the elections, the two lines begin to diverge substantially. While per capita GDP growth decelerates in Kenya, for its synthetic counterpart per capita GDP keeps ascending at a rate similar to that of the pre-election period. Figure 2 plots the yearly gaps in per capita GDP between the real Kenya and its synthetic country, where the biggest difference between the two series is observed in 2009, and then it begins to slowly decrease.

We find that over the period 2007-2011, per capita GDP was reduced by an average of 70 USD per year, which amounts to be approximately 5 percent of the 2007 baseline level. In 2009, per capita GDP in the actual Kenya is estimated to be about 6 percent lower than in its synthetic counterpart.

### 4.3 Placebo Study

An advantage of using the synthetic control methods is that it can be used to conduct falsification exercises, called "placebo studies". We still have to answer a question regarding the significance of the estimates: what if those results are obtained by chance? If you conduct this alternative model and you obtain effects of similar or greater magnitudes when the event has not taken place, it will undermine the validity of the results. There are two types of falsification exercises, one is reassign the intervention in time, as called by Abadie, Diamond, and Hainmueller (2012), "in-time placebos" and the other one is to reassign the intervention to units that have not being directly exposed.

Regarding the first case, "in-time placebos", Abadie, Diamond, and Hainmueller (2012) study the effect on per capita GDP in West Germany after the reunification of 1990 and conduct a placebo study as if the reunification had taken place in dates prior to 1990, in fact they calculate the effect for the 1960-1990 period where Germany did not experience any structural shock to the economy. If they would find the same or similar large effect when the event did not take place, their confidence that the effect they estimated is due to the 1990 reunification would be diminished. The result was that there is no perceivable effect and the per capita GDP trajectory of West Germany and its synthetic do not diverge considerably, therefore the gap estimated actually reflects the German reunification.

We also conducted an in-time placebo for the period before the election took place. As explained before, I took data from 2002 to isolate the effect of the 2007 election; therefore our placebo study is conducted from 2002 to 2007, assuming that the elections took place in 2005. As shown in Figure 3, the synthetic Kenya almost exactly reproduces the actual Kenya in the evolution of per capita GDP for the pre-election period and they do not diverge considerably after 2005. As this could not be a sufficiently large number of time periods we also compute the other type of placebo study in order to restate this result.

In the second type of falsification exercise, Abadie and Gardeazabal (2003) construct a synthetic "non-terrorism region" to see if the effect they calculated in the Basque country is truly due to terrorism. They compare it to Catalonia because is a region similar to the Basque Country, they are both highly industrialized regions, with historical demands for self-governance

and were the first two regional autonomy statutes of the post-Franco era in 1979. Per capita GDP for Catalonia is reproduced with high accuracy up to the late 1980's, and only outperforms its synthetic counterpart in 1990-1997 due to the Olympic Games that took place in Barcelona in 1992.

Abadie, Diamond, and Hainmueller (2010) also conducted a placebo study to states that did not implement a large-scale tobacco control program such as the one implemented in California in 1988, Proposition 99, during the sample period of their study. They applied the synthetic control method to every state in the donor pool as if one would have passed a large-scale tobacco control program in 1988 and they find out that the estimated gap for California during the 1989-2000 period is unusually large compared to the distribution of the gaps for the states in the donor pool.

Abadie, Diamond, and Hainmueller (2012) also estimated the placebo effects for every potential control unit in the donor pool. They calculate the post-1990 RMSPE and the pre-1990 RMSPE<sup>11</sup> ratios for all donor pool countries. The root mean square prediction error, RMSPE, measures the magnitude of the gap of the per capita GDP between each country and its synthetic counterpart. Prior to intervention, the RMSPE should be small, if not the synthetic control is not closely reproducing the outcome of interest prior to the intervention. If post-1990 RMSPE and the pre-1990 RMSPE were equally large then the estimated effect of the reunification, the prior is not indicative of a large effect of the intervention. They found that for West Germany the post-reunification gap was about 16 times larger than the pre-reunification gap.

In this paper we also computed the RMSPE prior and after 2007 for Kenya and all the donor pool countries, shown in Table 3. Kenya is after Ghana the country with the largest ratio between the post-2007 RMSPE and the pre-2007 RMSPE, the post-election gap is about 15 times larger than the pre-election gap. Ghana has a large ratio between the post-2007 RMSPE

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<sup>11</sup>Abadie, Diamond, and Hainmueller (2012). The RMSPE measures lack of fit between the path of the outcome variable for any particular country and its synthetic counterpart. The pre-election RMSPE error for Kenya is defined as:

$$RMSPE = \left[ \left( \frac{1}{T_0} \sum_{t=1}^{T_0} (Y_{1t} - \sum_{j=2}^{J+1} w_j^* Y_{jt}) \right)^2 \right]^{1/2}$$

The RMSPE can be analogously defined for other countries or time periods.

and the pre-2007 RMSPE because sound macro-economic management along with high prices for gold and cocoa helped sustain GDP growth in 2008-11<sup>12</sup>, in fact in 2011 its GDP grew at 11.76 percent. Table 3 displays the RMSPE of Kenya and all donor countries. A p-value can be computed by estimating the effect of the post-election violence for each unit of the donor pool and then calculate the proportion of estimated effects larger or equal to the one of Kenya. If one were to pick a country at random from the sample, the probability of obtaining a post/pre-election RMSPE ratio as large as Kenya's is  $2/22 = 0.091$ .

## 5 Conclusion

As defined before, the synthetic control method provides a data-driven procedure to construct synthetic control units based on a weighted combination of comparison units that approximates the characteristics of the unit that is exposed to the intervention. In this paper we use it to construct a weighted combination of potential African countries that approximate the most relevant economic growth indicators of the units exposed to the intervention.

We use the synthetic control method to study the effect of the post-election violence in Kenya after the 2007 election. The results suggest that over the period 2007-2011, per capita GDP was reduced by an average of 70 USD per year, which amounts to be approximately 5 percent of the 2007 baseline level. In 2009, per capita GDP in the actual Kenya is estimated to be about 6 percent lower than in its synthetic counterpart. This method also allows constructing different falsification exercises in order to study the significance of the estimates: relabeling the election date or the state where it took place among the donor pool countries. We show that in the later, the probability of obtaining the same magnitudes that the ones obtained for Kenya would be 0.091.

Violence has been a common factor on the four democratic elections that Kenya has had until 2012, next will be held on March 4<sup>th</sup> 2013, the government is already alerting the population and trying to prevent violence from happening.

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<sup>12</sup>CIA- The World Factbook, <https://www.cia.gov/library/publications/the-world-factbook/geos/gh.html>

## Appendix: Including Economic Freedom

As explained in the subsection ‘Data and Sample’ we have tried different combinations of variables to check that our results are robust across different datasets. In this appendix we briefly discuss the results when including the variable Economic Freedom. It is an index done by The Heritage Foundation. They measure ten components of economic freedom and group them in four pillars. The first is the rule of law, where property rights and freedom from corruption are included. The second category is Limited Government, within this, fiscal freedom and government spending are accounted. Third, Regulatory Efficiency, where business freedom, labor freedom and monetary freedom are introduced. Finally, the fourth pillar is Open Markets formed by trade freedom, investment freedom and financial freedom. They assign each individual freedom a grade between 0 and 100, where 100 represents the maximum freedom. The country’s index score is a simple average of the scores in the ten components.

We use the same annual country panel data for the period 2002-2011 and the same economic growth determinants but including now economic freedom as well. There are three countries of the previous donor pool that have no data on economic freedom: Angola, Congo Dem.Rep. and Sudan. Therefore, our donor pool this time includes the 18 remaining countries: Algeria, Benin, Botswana, Cameroon, Congo Rep., Cote d’Ivoire, Egypt, Arab Rep., Ethiopia, Gabon, Ghana, Morocco, Mozambique, Senegal, South Africa, Tanzania, Togo, Tunisia and Zambia.

We construct again a synthetic Kenya as a convex combination of different countries which resembles many relevant economic characteristics of Kenya before the post-election violence of 2007. The new results are displayed in Table A1; it compares pre-election characteristics of the actual Kenya with its synthetic Kenya, as well as a weighted average of the 18 African countries that we have in the donor pool. These figures show how well the weighted combination of control countries reproduces the values of economic predictors for Kenya before the post-election violence.

Table A2 displays the weights of each control state in the synthetic Kenya. The weights reported indicate that the economic predictors for Kenya before the post-election violence of 2007 are best reproduced by a combination of Benin, Cote d’Ivoire, Ethiopia, South Africa,

Tunisia and Zambia. All other states in the donor pool are assigned zero weights.

Figure A1 displays the per capita GDP evolution of Kenya and its new synthetic country for the 2002-2007 period. The synthetic Kenya reproduces almost perfectly the per capita GDP for Kenya during the pre-election period. We find that over the period 2007-2011, per capita GDP was reduced by an average of 86 USD per year, when before was 70, which amounts to be approximately 6 percent of the 2007 baseline level. In 2010, per capita GDP in the actual Kenya is estimated to be about 8 percent lower than in its synthetic counterpart. Therefore, it is seen that the gap obtained including economic freedom is slightly larger than before.

We also analysed the in time placebo falsification exercise. We computed the ratio between the post-2007 RMSPE and the pre-2007 RMSPE; the post-election gap for Kenya now is higher, more than 17 times larger than the pre-election gap. Kenya is still after Ghana, the country with the largest ratio between the post-2007 RMSPE and the pre-2007 RMSPE; however, if one were to pick now a country at random from the sample, the probability of obtaining a post/pre-election RMSPE ratio as large as Kenya's is  $2/18 = 0.111$ .

Although the gap obtained including economic freedom is larger, the probability of obtaining the same RMSPE ratio is also larger. This is the reason why we have maintained the original dataset and variables. Nevertheless, we thought it was worthwhile to include them in this appendix.

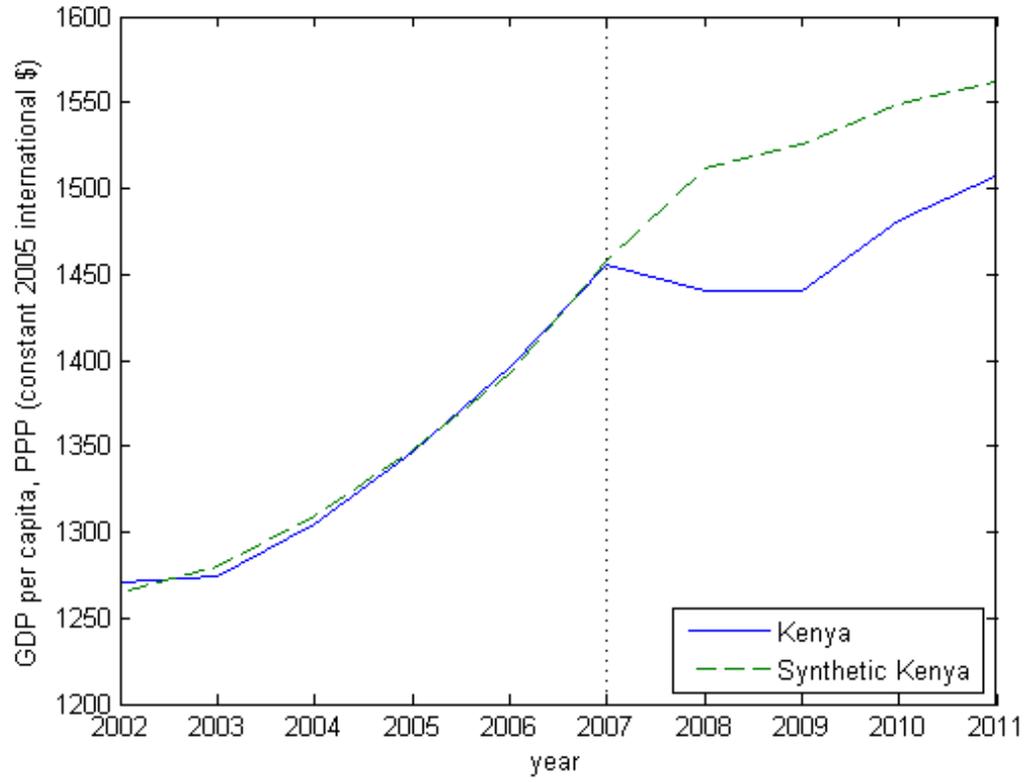
## References

- [1] Abadie, A., A. Diamond, and J. Hainmueller. 2010. "Synthetic Control Methods for Comparative Case Studies: Estimating the Effect of California's Tobacco Control Program." *Journal of the American Statistical Association*. 105(490): 493-505.
- [2] Abadie, A., A. Diamond, and J. Hainmueller. 2012. "Comparative Politics and the Synthetic Control Method." MIT Political Science Department Research Paper No. 2011-25
- [3] Abadie, A. and J. Gardeazabal. 2003. "The Economic Costs of Conflict: A Case Study of the Basque Country." *American Economic Review*. 93(1): 112-132.
- [4] Alesina, A., S. Ozler, N. Roubini and P. Swagel. 1996. "Political Instability and Economic Growth." *Journal of Economic Growth*, 1, 189-211.
- [5] Artadi, E. and Sala-i-Martin. 2003. "The Economic Tragedy of the XXth Century: Growth in Africa". NBER Working Paper No. 9865.
- [6] Commonwealth Secretariat. 2008. "Kenya General Election, 27 December 2007." The Report of the Commonwealth Observer Group.
- [7] Dimitri. 2011. "Measuring the economic cost of the 2007-2008 election crisis in Kenya." Laterite, Transforming Advisory Services in Kenya. <http://www.laterite-africa.com/index.php/measuring-the-economic-cost-of-the-2007-2008-election-crisis-in-kenya/>
- [8] Enders, W. and Olson, E. 2012. "Measuring the Economic Costs of Terrorism." The Oxford Handbook of the Economics of Peace and Conflict, chapter 16.
- [9] Gardeazabal, J. 2010. "Methods for Measuring Aggregate Costs of Conflict." The Oxford Handbook of the Economics of Peace and Conflict.
- [10] Gibson, C.C., Long J.D. 2009. "The presidential and parliamentary elections in Kenya, December 2007." *Electoral Studies* (2009), doi:10.1016/j.electstud.2009.01.005
- [11] International Crisis Group. 2008. "Kenya in Crisis". Africa Report N°137 – 21 February.

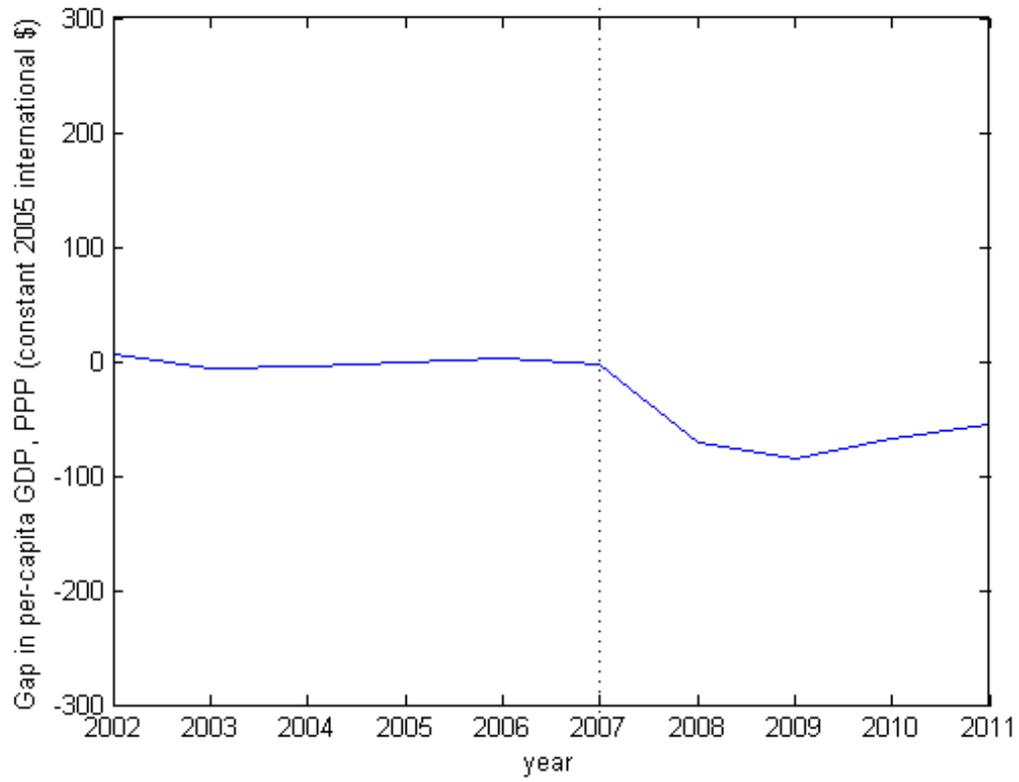
- [12] Open Society Institute, East Africa Initiative (OSIEA). 2008. "The Electoral Process in Kenya: A Review of Past Experience and Recommendations for Reform." IFES Final Report.
- [13] Roberts, Mara J. 2009. "Conflict Analysis of the 2007 Post-election Violence in Kenya". New Dominion Philanthropy Metrics, No.14.
- [14] The Economist. "Corruption in Kenya: How to Ruin a Country". February 26, 2009.
- [15] United Nations High Commissioner for Human Rights. "Report from OHCHR Fact-finding Mission to Kenya, 6-28 February 2008.
- [16] World Bank. Poverty Reduction and Economic Management Unit Africa Region. 2008. "Kenya Poverty and Inequality Assessment. Volume I: Synthesis Report". Report No. 44190-KE.

## FIGURES

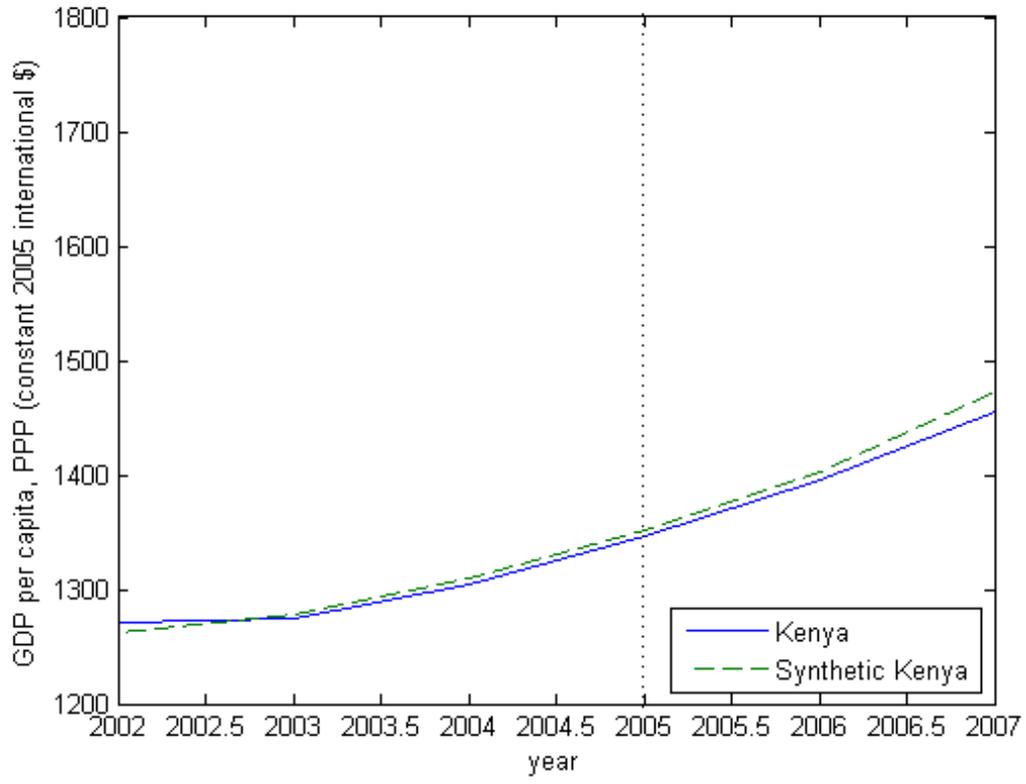
**Figure 1:** Trends in Per-Capita GDP: Kenya vs. Synthetic Kenya



**Figure 2:** Per-Capita GDP Gap Between Kenya and Synthetic Kenya



**Figure 3:** Placebo election 2005 - Trends in Per-Capita GDP: Kenya vs Synthetic Kenya



## TABLES

**Table 1:** Economic Growth Predictor Means before 2007 elections

	Kenya	Synthetic Kenya	Donor Pool
	(1)	(2)	(3)
Real per capita GDP <sup>a</sup>	1341.18	1349.6	3610.12
Population density <sup>b</sup>	61.81	56.17	42.77
FDI, inflow (%)	0.67	2.81	4.27
Sectoral value added (%)			
- Agriculture	27.53	28.51	21.39
- Services	54.25	51.05	44.90
- Industry	18.22	20.44	33.70
Energy production <sup>c</sup>	13717.10	8063.54	29561.69
Inflation rate <sup>d</sup>	9.65	7.54	8.53
Exports of goods and services (%)	26.33	22.2	36.61
Imports of goods and services (%)	34.11	33.75	37.38
Life expectancy at birth, total (years)	52.93	52.99	56.45

Source: World Development Indicators and Global Development Finance, World Bank.

Note: All variables are averaged for the period 2002-2007.

<sup>a</sup> GDP per capita, PPP (2005 international dollars).

<sup>b</sup> People per sq. km of land area.

<sup>c</sup> kt of oil equivalent.

<sup>d</sup> Consumer prices (annual %).

**Table 2:** Synthetic Weights for Kenya

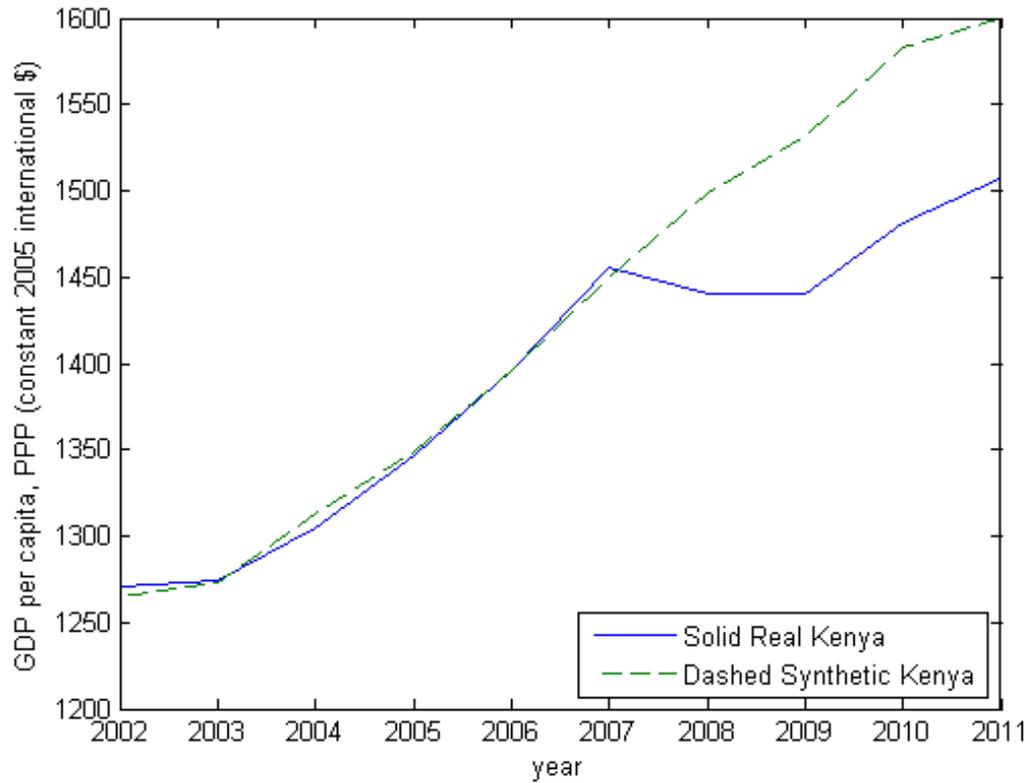
Country	Weight	Country	Weight
Algeria	0.00	Ghana	0.00
Angola	0.05	Morocco	0.00
Benin	0.50	Mozambique	0.09
Botswana	0.00	Senegal	0.18
Cameroon	0.00	South Africa	0.00
Congo, Dem. Rep.	0.00	Sudan	0.00
Congo, Rep.	0.00	Tanzania	0.00
Cote d'Ivoire	0.00	Togo	0.00
Egypt	0.00	Tunisia	0.00
Ethiopia	0.11	Zambia	0.07
Gabon	0.00		

**Table 3:** Ratio of post-election RMSPE to pre-election RMSPE

Country	Ratio	Country	Ratio
Kenya	14.34	Gabon	0.62
Algeria	2.60	Ghana	24.23
Angola	3.76	Morocco	5.25
Benin	2.8	Mozambique	0.94
Botswana	0.93	Senegal	5.02
Cameroon	2.86	South Africa	1.62
Congo, Dem. Rep.	1.54	Sudan	3.37
Congo, Rep	2.21	Tanzania	3.99
Cote d'Ivoire	2.24	Togo	1.79
Egypt	7.5	Tunisa	2.65
Ethiopia	3.95	Zambia	2.79

## FIGURES APPENDIX

**Figure A1:** Trends in Per-Capita GDP: Kenya vs Synthetic Kenya



## TABLES APPENDIX

**Table A1:** Economic Growth Predictor Means before 2007 elections

	Kenya	Synthetic Kenya	Donor Pool
	(1)	(2)	(3)
Real per capita GDP <sup>a</sup>	1341.18	1347.83	3617.13
Population density <sup>b</sup>	61.81	51.75	46.90
FDI, inflow (%)	0.67	4.10	3.80
Sectoral value added (%)			
- Agriculture	27.53	31.83	19.98
- Services	54.25	47.92	47.28
- Industry	18.22	20.25	34.74
Energy production <sup>c</sup>	13717.10	14473.24	28036.78
Inflation rate <sup>d</sup>	9.65	9.59	5.82
Exports of goods and services (%)	26.33	23.17	36.03
Imports of goods and services (%)	34.11	32.79	37.35
Life expectancy at birth, total (years)	52.93	51.08	57.29
Economic Freedom <sup>e</sup>	58.61	54.60	56.04

Source: World Development Indicators and Global Development Finance, World Bank.

Note: All variables are averaged for the period 2002-2007.

<sup>a</sup> GDP per capita, PPP (2005 international dollars).

<sup>b</sup> People per sq. km of land area.

<sup>c</sup> kt of oil equivalent.

<sup>d</sup> Consumer prices (annual %).

**Table A2:** Synthetic Weights for Kenya

Country	Weight	Country	Weight
Algeria	0.00	Ghana	0.00
Angola	0.00	Morocco	0.00
Benin	0.27	Mozambique	0.00
Botswana	0.00	Senegal	0.00
Cameroon	0.00	South Africa	0.03
Congo, Dem. Rep.	0.00	Sudan	0.00
Congo, Rep.	0.00	Tanzania	0.00
Cote d'Ivoire	0.06	Togo	0.00
Egypt	0.00	Tunisia	0.01
Ethiopia	0.32	Zambia	0.31
Gabon	0.00		