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Abstract

This paper investigates the impact of international state-building efforts on economic development in Somalia. Due to non-existent or poor-quality national income accounts, we use satellite data capturing night light emissions to measure economic activity. Using the synthetic control method, we find that the establishment of the Transitional Federal Government in 2004 was associated with economic stagnation relative to the years prior, where Somalia did not have a formal government. This result of economic stagnation remains whether we use the total lights emitted from the country or the spread of lights across the country. Our empirical findings are consistent with the idea that the exogenously imposed Transitional Federal Government destabilized the country through an incongruity with the informal institutions that had led to development during Somalia's 'statelessness.'

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1 Introduction

Economists have long been concerned with the various factors that may influence the trajectory of a country's economic development. One need not look in depth at the difference between low income and high income countries to see the disparity in many indicators and the plausible relationship between various economic factors and those that measure quality of life. Many scholars have attributed the large difference in the magnitude of these indicators to the strength of institutions (North, 1994b; Hall and Jones, 1999; Mehlum et al., 2006). The determinants of institutional quality, however, are the subject of considerable debate (Alonso and Garcimartín, 2013). In the case of property rights and their role in economic development, for example, Williamson and Kerekes (2011) argues that formal institutions merely codify informal property institutions. Regardless of the weight placed on formal versus informal institutions, it is clear that existing institutions are the product of historical choices and experiences (North, 1990; David, 1994). Attempts to improve institutions must recognize the current state of affairs (North, 1994a), especially those that constrain violence (North et al., 2009).

Boettke and Fink (2011) argue that that while successful institutional change begins with an understanding of current institutions and the beliefs of individuals in society, it matters *how* institutional change occurs. Building off of Boettke et al. (2008), they differentiate between two types of institutional change: endogenous and exogenous. Endogeneous change arises from the interactions between individuals and organizations in society, without any centralized government involvement. Whenever you have individuals interacting socially in society, institutions evolve to overcome obstacles to cooperation (Hayek, 1996). These spontaneous institutions are more likely to be durable because they map onto the incentives and mental models individuals have in a given society. Exogenously-determined institutional change, on the other hand, is change initiated from the top down. In the case of a domestic government, internal exogenously-imposed changes can be durable if they can map onto pre-existing informal institutions and mental models. The knowledge problem (Hayek, 1945),

however, makes it less likely that domestic governments are going to be able to choose institutional reforms that 'stick.' Externally-imposed exogenous changes are those imposed by groups outside a society, such as in the case of post-war Reconstruction (Coyne, 2008). These are least likely to last because foreign governments are the most unfamiliar with domestic institutions and beliefs (Boettke and Fink, 2011).

It is not just that the exogenously-imposed institutional changes do not 'stick.' In some cases the imposed changes can make a society poorer by disrupting pre-existing informal institutions. Leeson and Harris (2018), for example, consider the case of Kenya's nomadic herders, the Maasai. In pre-colonial Africa, the Maasai had a property-right regime where land was in the commons but livestock was private. Their communal land rights mapped well onto the dry and arid conditions they faced, since the ability to move one's herd to an area not suffering from drought acted as a form of insurance. Kenya's colonizers, however, saw the Maasai's regime as wasteful and proceeded to privatize the land. The privatization of land rights, according to Leeson and Harris (2018), led to a decline in livestock production of between 60 and 90 percent, depending on the type of livestock. Other examples include the US government and property rights on Native American lands (McChesney, 1990), privatization in Cambodia (Loehr, 2012), and land reform in Afghanistan (Murtazashvili and Murtazashvili, 2017).

In this paper, we study the imposition of political and legal institutions in Somalia in 2004 in the form of the Transitional Federal Government (TFG). The TFG was the externally-recognized national government of Somalia between 2004 and 2012. After the collapse of the Barre regime in 1991, Somalia had been without a centralized government (Hesse, 2010). This period that has been described as 'anarchic' by Leeson (2007) and Powell et al. (2008). These papers provide evidence that clan governance – particularly in Somalialand and Puntland – was better for economic progress and well-being. Anarchy, however, was not a stable equilibrium as the lack of a centralized government was a concern for many individuals, countries, and international organizations. In particular, the United Nations, the African

Union, the Arab League, and others hoping to have influence in a creating a reformed Somalia government had a strong interest in ending 'statelessness' (Hesse, 2010). As a result, the TFG was born out of political negotiations in nearby Kenya in 2004.

This paper investigates the impact of the TFG on Somali development. To accurately measure economic activity, we use nighttime lights recorded by satellites Henderson et al. (2012); Shortland et al. (2013). To obtain a counterfactual where the TFG did not come to control Somalia, we utilize the synthetic control method (SCM). Our empirical results show that Somalia began to economically stagnate immediately following the imposition of the TFG in 2004. These results are consistent with the view that the TFG, despite its best intentions, did not match the institutions that were keeping a lid on violence in Somalia. Our findings are consistent with observer reports suggest that violence increased and economic productivity declined after the TFG began attempting to assert control over Somalia (Menkhaus, 2007).

The paper is organized as follows. Section 2 discusses the Night Light data, while Section 3 discusses the Synthetic Control Method and our application of it in this paper. Section 4 presents our baseline results, with Section 5 conducting robustness on the results with different dependent variables and a separate donor pool for the synthetic. Finally, Section 6 offers concluding remarks and discussion of the implications of this research.

2 Light Data

Many issues exist with GDP measurements for counties with developing institutions, including Somalia (Leeson, 2007). In addition, since the period of interest for the current study involves a period of statelessness, those suspect estimates become even more difficult to trust.[1] To compensate for this, we use night light emissions gathered from the National Oceanic and Atmospheric Association's (NOAA) Defense Meteorological Military Satellite Program (DSMP). This system has the unique capability of being able to detect visible light

[1]The World Bank does not even have GDP measurements for Somalia after 1991.

from cities. These emissions are then separated from possible distortions, such as those that may come from moonlight, cloud coverage, gas flares, and fires (Elvidge et al., 1997). These satellites orbit the earth 14 times a day, covering every location on the earth at some time between 8:30 PM and 10:30 PM (Henderson et al., 2012).

The data is collected in 1-km pixels, creating a fine-grained reference grid of light emissions across the globe, and is available from 1992-2013. Information from the satellites is collected by the NOAA, cleaned to remove cloud coverage, and averaged for a single value across the entire year. In many cases, there are multiple satellites orbiting the earth in a given year. When this is the case, the light measurements are averaged between the two satellites.[2]

Night light emissions have allowed economists to utilize a unique new data set to study economic activity, particularly in developing countries where official measurements are less reliable (Chen and Nordhaus, 2011). A potential issue for some studies is that the light measurement for each pixel is top-coded at 63. The traditional concern with this top coding is that two cities that greatly differ in economic activity could show the same light measurement as they both exceed this threshold. Due to the low level of light emissions in Somalia and our donor pool counties, this is not an issue for the current study.

In an exercise to compare official GDP measurements with those created by the night light data, Henderson et al. (2012) finds that the two measurements vary by only three percentage points annually. While we do not have any measurement of GDP for Somalia in a majority of the years of our sample, this affirms that lights are a useful proxy for economic activity within the country. Ghosh et al. (2010) utilize regressions of official GDP measurements and light emissions in an attempt to capture the informal economy that would not be seen in official statistics. Henderson and Kriticos (2018) and Henderson et al. (2017) investigate additional questions as it pertains to economic development in Africa and the role

[2]Different satellites may record different magnitudes of light. This is due to differences in the calibration of the satellites. However, because we are using the same satellites for each country in a given year, any bias for one country should be offset by a similar bias in the others.

of geographic variation in the development of cities. Shortland et al. (2013) use night lights to evaluate the effect of conflict withing Somali cities on economic activity from 1993 to 2009. Their results from this period of statelessness show that the heavy conflict in southern Somalia led to a collapse in the intensity of light emissions, as well as the number of areas emitting lights.

3 Synthetic Control

3.1 Overview of the Method and its Application

In order to study the effects of the establishment of the TFG in Somalia, we cannot only look at changes that occurred after the implementation. For the analysis to suggest the TFG had any remarkable impact on the economic activity in Somalia, we must compare the progress of economic activity in Somalia to the progress that would have occurred had it not been imposed. However, we are only able to collect data on reality, in which the TFG was imposed on Somalia. There is no reality for the counter-factual, in which the TFG was not formed (i.e., we have no observations post-2004 in Somalia where the TFG was not imposed). To overcome the issue of an unobservable counter-factual, Abadie and Gardeazabal (2003) developed the synthetic control method (SCM). This empirical technique can be implemented to explore how a policy shock changed the trajectory of the treated unit. In utilizing this method, we create a weighted average of countries to construct a synthetic country that acts similar to Somalia during the pre-treatment period.[3] This synthetic then creates the counter-factual of a post-2004 without the creation of the TFG that we are unable to observe in the real world. The impact of the TFG on Somalia would then be captured by the difference between the synthetic and actual Somalia post-2004.[4]

[3]Our treatment is defined as Somalia post-2004 following the establishment of the TFG.
[4]For a detailed description of the method see Abadie et al. (2010).

Abadie et al. (2010) and Abadie et al. (2015) test the applicability and validity of the synthetic control method to comparative case studies in policy and political transitions, using a large-scale tobacco law in California and the 1990 reunification of Germany, respectively. Previous papers using synthetic control to study the impact of political changes use GDP per capita to measure the impact of these shocks. Grier and Maynard (2016) study the impact of Hugo Chavez on Venezuela, and finds that the administration hurt or did not meaningfully increase the economic performance of the country on various measurements of well-being. Zhou (2018) implements a similar study evaluating the economic impact of the movement led by Bo Zilai in Chongqing, China, finding that he had a negative impact on short-run economic growth and performance. A robust study of the effect of economic liberalization found that historically this liberalization has led to positive effect, though the recent effects in Africa were largely unsuccessful (Billmeier and Nannicini, 2013).[5]

3.2 Donor Pools

Important in the creation of a reliable synthetic is the match of the predictor variables for the real country and the synthetic. At the most basic level, the selection of which countries should be included in the "donor pool" is of primary concern to the analysis. This donor pool should include countries that are similar to the country of interest on both time-varying and time-invariant measurements. In addition, it is important that the countries in the donor pool are not affected by the intervention within Somalia, and that they did not experience any similar shocks around the time of intervention.

The first requirement for our primary donor pool is that the country is designated as a Least Developed Countries by the United Nations Committee for Development Policy.[6] In addition, we only consider those countries that were also within the Top 50 of the Fragile

[5]Other recent papers utilizing SCM to study regime changes include Powell et al. (2017), Jales et al. (2018), Lawson et al. (2019), and Geloso and Pavlik (2020). Skarbek (2020) argues that SCM is a good way to wed qualitativea nd quantitative institutional analysis. Pfeifer et al. (2018) is the only paper of which we are aware that uses night lights and the SCM. They evaluate the impact of hosting the World Cup on local economic development.

[6]South Sudan is excluded from the analysis as it did not gain independence from Sudan until 2007.

State Index (FSI) in 2006.[7] This leaves us with a final donor pool of 28 countries (including Somalia) that are designated as LDCs and are within the Top 50 of the FSI in 2006. A full list of LDC countries and their FSI Rank is presented in Table 1.

Table 1: List of LDC Countries

Country	FSI Rank (2006)	Country	FSI Rank (2006)
Afghanistan	10	**Liberia**	11*
Angola	37*	Madagascar	–
Bangladesh	19	**Malawi**	29
Benin	90	Mali	81
Bhutan	39*	**Mauritania**	41
Burkina Faso	30	Mozambique	80
Burundi	15	**Myanmar**	18
Cambodia	47*	**Nepal**	20
Central African Republic	13	**Niger**	44
Chad	6*	**Rwanda**	24
Comoros	–	Sao Tome and Principe	–
Dem. Republic of the Congo	2	Senegal	98*
Djibouti	–	**Sierra Leone**	16*
Eritrea	54	Solomon Islands	–
Ethiopia	26	**Somalia**	6*
Gambia	83	**Sudan**	1
Guinea	11*	Tanzania	71
Guinea-Bissau	46	Timor-Leste	–
Haiti	8	**Togo**	37*
Kiribati	–	**Uganda**	21
Laos	39*	Vanuatu	–
Lesotho	–	**Yemen**	16*

Notes: FSI = Fragile States Index. $*$ represents a tie in the FSI. FSI rank was used for 2006 as it is the first year that data set was published, and should reasonably estimate the state of affairs in each respective nation in the years prior. Countries in **bold** are within the Top 50 of the FSI and the donor pool.

In the creation of the synthetic, some countries will be given positive weights, while many will contribute no weight to the synthetic. Within our initial donor pool, we believe the refinement is proper. However, it may be the case that those countries that are within the Top 50 of the FSI are also facing interventions that the authors are unaware of. For this

[7]This is an index published annually by the Fund for Peace since 2006. Even though the intervention of the TFG occurs in 2004, 2006 is the first year of publication. These rankings do not vary widely year-to-year. However, to account for potential variation, we include a broad list of these countries by using the Top 50 of the index. In 2006, Somalia is tied for 6th.

reason, we explore a separate donor pool within the robustness section. In this latter donor pool, all LDCs are considered, regardless of their position in the FSI. This will allow for a broader creation of the synthetic and potentially incorporate countries that are similar to Somalia on characteristics other than state fragility. Importantly, the countries that border Somalia have large percentages of people who are of Somali descent. For this reason, it is especially important to exclude Ethiopia and Djibouti from the analysis.[8]

3.3 Dependent Variables

In our primary analysis, three dependent variables are used. First, the Sum of Lights (SOL) represents the total sum of all light emissions within the country. That is, all of the values (on a scale of 0 to 63) for each pixel within the country are added together to get a total value for lights within the country. This will of course be correlated with the size of the country. As Henderson et al. (2017) state: "Lights are bright in northern India and the eastern United States, because while economic activity per person is lower in India, population density is higher." The size of the country does not necessarily pose a threat to the identification, nor does population density. When considering a country on a national scale, there are areas of the country that will be densely populated, and others that will be sparsely populated. In creating our synthetic, controlling for the size of the country and the population density will not necessarily reflect those countries that are best to create a synthetic of Somalia based on the many other predictor variables that will ensure that the economic and social composition of the synthetic relates relatively well to that of Somalia. In addition, Somalia's light measurement when transformed to reflect population or size is uniquely low relative to the donor pool counties. This makes it very difficult to create a synthetic that performs as a reasonable counterfactual of the treated unit.

Second, to remain consistent with other literature that uses night light emissions to evaluate economic activity, we include a specification with the natural logarithm of the SOL

[8]Kenya also borders Somalia, but it is not an LDC.

measurement as the dependent variable. This variable will capture similar trends as the baseline SOL version, however, it will be less sensitive to larger values and thus may warrant inclusion of countries that are similar to Somalia on control variables but different on the SOL measurement.

Lastly, it is important to measure the breadth of economic activity within a country, not merely the intensity. To proxy for this, we use the total number of pixels that are illuminated within the country. Ideally, we would prefer to use the percentage of pixels that experience non-zero light measurements. However, Somalia is a relatively large country compared to the others in the donor pool. In addition, Somalia produces very few non-zero pixels. For this reason, the ratio is nearly unique in the low percentage of pixels that emit light relative to the total number of pixels. For this reason, the total number of pixels with a non-zero value are used.[9]

3.4 Control Variables

We have previously discussed the limitations of using reported data from LDCs. Reasonable proxies do not exist for all economic indicators, so we must accept that there may be discrepancies within the data for any country in any given year. With that being said, the variables are collected from the World Bank and the United Nations, and thus provide us with the best estimates that we could potentially find for the variables we are interested in. All variables are listed in Table 2.

Birth to death ratio is a variable that is constructed by the authors using the birth rate and death rate collected from the World Bank World Development Indicators. Also collected from this data source are neonatal mortality rate, male life expectancy, rate of tuberculosis per 100,000 people, and the percentage of the population with access to electricity. First, measurements on life expectancy and mortality rate allow us to capture social and health

[9]This has the potential, as with the SOL, to represent countries that are much smaller than Somalia, as they have fewer pixels and thus will be closer to the total number of pixels with non-zero values as Somalia. For the reasons explained when describing the SOL measurement, we suggest that this is not a problem for the results of the analysis, though it is important to keep in mind.

Table 2: Variable List and Sources

	Source
Sum of Lights	NOAA
Non-Zero Pixels	NOAA
Birth to Death Ratio	World Bank
Neonatal Mortality Rate	World Bank
Male Life Expectancy	World Bank
Retail Total Value Added	UN National Accounts
Mining Total Value Added	UN National Accounts
Manufacturing Total Value Added	UN National Accounts
Construction Total Value Added	UN National Accounts
Transportation Total Value Added	UN National Accounts
Tuberculosis Rate (per 100,000)	World Bank
% Population with Electricity Access	World Bank
List of Least Developed Countries	UN Committee for Development Policy
Fragile State Index Rank	Fund for Peace

determinants of the country. These are generally more improved in countries that are more highly developed, and thus will allow us to ensure that we are controlling for the state of health affairs within our synthetic. Additionally, the incidence of tuberculosis speaks to a similar problem, though the disease may flourish in different environments and may be more pronounced in areas where individuals are more reliant on each other, such as rural villages. The average of each of these variables throughout the pre-intervention period is used in the creation of our synthetic, with the exception of the tuberculosis rate as these data did not become available until 2002.

The percentage of the population with access to electricity is of primary importance in the analysis. Night lights can only be captured if people have access to electricity to produce the lights. This presents a challenge, as Somalia has a much smaller percentage of the population with access to electricity than many of the LDCs included in any of our specifications. Another issue with these data is that they are not collected over the same period for each donor pool country. Because of this, the first year in which nearly all of the countries have an estimate entered is 1998, and thus the average is taken for 1998-2004. In addition, the lights that are present within the first year of the TFG, which should be a reasonable proxy for the state of electricity capital within Somalia prior to the full

intervention of the TFG, is included.

In addition to the variables from the World Bank, five variables were collected from the UN National Accounts Main Aggregates Database.[10] These variables all represent the percentage of value added by economic activity within various sectors. These sectors are retail, mining, manufacturing, construction, and transportation. All five of these variables are included within each specification and averaged over the pre-treatment period of 1995-2004. The inclusion of these variables attempts to select countries that are most similar to Somalia in their economic activity, thus will potentially be sensitive to the same macroeconomic influences.

Before proceeding to the analysis, there are two necessary points to discuss. First, the period of investigation is bounded by international activity within the country. On the front-end of the time-line, the United Nations Operation in Somalia (UNOSOM II: 1993-1995) was an internationally collective attempt to progress nation-building initiatives, create law-and-order, and rebuild much of the infrastructure that was destroyed over the preceding decade. Investigating the economic activity in the country during this period would cloud the results of night-light emissions due to the interventionist resources devoted to the country. Thus, the period of analysis begins in the year of withdrawal of this UN task force in 1995. It is important to note that beginning in 2007, a 4,000-man peacekeeping effort led by the African Union Mission to Somalia (AMISOM) established itself within country borders, leading to another potential upward bias in the reporting of lights as it relates to economic activity. While it would be ideal to remove this period, it is not currently possible as AMISOM still operates within the country in 2018.

Additionally, on August 1, 2012 the TFG's term in the country came to an end with the approval of a provisional constitution for the new Federal Democratic Republic of Somalia (FGS) (Zoppi, 2018). However, heading into 2009 Somalia was home to the worlds worst humanitarian crisis at the time, with over 1.3 million people displaced. This event spurred

[10]Accessed at: https://unstats.un.org/unsd/snaama/resQuery.asp. Former Sudan was used for Sudan 1992-2007, while the mainland of Tanzania was used for the entire period (Zanzibar was excluded).

an additional conference in which Ethiopia restricted its involvement within Somalia and international organizations increased their participation within the country. This was surely not without its own problems, as Somalia was one of the most dangerous places for an aid worker at the time. However, the shift in the dynamic within the country makes the analysis more difficult as it may be measuring two separate events. The large city of Mogadishu also played home to many of those who were seeking refuge (Shortland et al., 2013), which may increase the light values for the area if they were receiving a large amount of humanitarian aid around this period, which the authors suggest is the case. For these reasons, 2009 is used as the end of our horizon. Thus, our period of investigation is from 1995-2009.

It is important to remember the division within the Somali people. Two independent states have developed within the northern portion of the country (Somalialand and Puntland). These areas are still included within the measurements for Somalia and could potentially be effecting the results we see within each of our synthetic controls. This, if anything, should downward bias the gap between our synthetic and actual Somalia, as these areas have enjoyed relative peace and prosperity since their establishment. They are not omitted, however, because the Transitional Federal Government still had official jurisdiction over the areas since they are not recognized as independent countries on the international stage. Additionally, our control variables are included for the entire country of Somalia. Since the two independent states are not internationally recognized, it is supposed that these areas are still taken into consideration, and thus we would be unable to say that the control variables represent values for only the southern part of Somalia.

4 Results

As mentioned previously, Somalia is a unique country with its situation of prolonged conflict and absence of a formal government. As such, finding a reliable donor pool to create the synthetic is a challenging task. The most reasonable donor pool that could be created would

include those countries that are designated as Least Developed Countries (LDCs) by the UN. However, this does not solve all of the potential issues. LDCs could be on that list because they are newly formed, or simply in remote areas. To alleviate this potential concern, we also only include those LDCs that are within the Top 50 of the Fragile State Index for its first year of publication, 2006. The primary results are using this donor pool, though another is explored in the robustness section of this paper. For all specifications, the dependent variable and all control variables, except the tuberculosis rate and the percentage of the population with access to electricity, are averaged across the entire pre-intervention period. The tuberculosis rate is averaged over 2002-2004, while the electricity access is averaged across 1998-2004 and additionally included for 2004.[11]

The analysis will proceed as follows. The main synthetic will use the Sum of Lights (SOL) which measures the total lights emitted within a country for a specific year. This is the sum of all pixel values (which range between 0-63 globally) that are non-zero within the country. Thus, this acts as a good proxy for the total economic activity within the country, though there are potentially caveats that it could be reflecting population which was addressed in an earlier section of this paper. Following the analysis on the SOL, we consider the natural logarithm of the lights value, similar to Henderson et al. (2012) and Henderson and Kriticos (2018). Lastly, the analysis concludes with an investigation of the spread of the lights within the country by conducting the synthetic on the total number of non-zero pixels.

4.1 Sum of Lights

The results for the predictor fit of synthetic and true Somalia can be found in Table 3. As the table shows, synthetic Somalia performs much more closely to true Somalia during the pre-intervention period than the full sample of the donor pool.

Out of 27 countries within the donor pool, 4 countries are given a non-zero weight.

[11] Ferman et al. (forthcoming) suggest not using the mean of all pre-intervention outcomes for all economic predictors. This method makes the most sense for the variables that we have included. The authors do not offer a suggestion to specifically improve the selection of other variables. For this reason, we remain consistent with the previous SCM literature.

Table 3: Predictor Fit for Sum of Lights

Variable	Somalia	Synthetic	Sample Mean
Sum of Lights (Avg. 1995-2004)	3431.76	3467.40	33135.37
Birth to Death Ratio	3.06	2.80	3.10
Neonatal Mortality Rate	44.44	45.16	42.28
Male Life Exp.	48.65	49.41	51.94
Retail TVA (%)	10.61	9.67	14.82
Mining TVA (%)	3.14	6.09	16.54
Manufacturing TVA (%)	2.47	3.26	9.48
Construction TVA (%)	4.19	2.59	5.20
Transportation TVA (%)	9.53	5.65	6.49
Tuberculosis Rate (Avg. 2002-2004)	285.00	261.04	264.59
% Electricity Access (Avg. 1998-2004)	7.51	6.99	18.95
% Electricity Access (2004)	11.34	8.99	22.07

These weights can be found in Table 4. The four countries that get weight are Bhutan, Liberia, Sierra Leone, and Yemen, with Liberia and Sierra Leone contributing the most to the synthetic. These weights are used to create a weighted average of countries that reflected similar characteristics to Somalia in the pre-intervention period. This synthetic should give us a good prediction of how economic activity in Somalia would have progressed if the intervention did not occur.

Table 4: Country Weights for Sum of Lights Synthetic

Country	Weight	Country	Weight
Afghanistan	0	Laos	0
Angola	0	Liberia	0.685
Bangladesh	0	Malawi	0
Bhutan	0.089	Mauritania	0
Burkina Faso	0	Myanmar	0
Burundi	0	Nepal	0
Cambodia	0	Niger	0
Central African Republic	0	Rwanda	0
Chad	0	Sierra Leone	0.210
Democratic Republic of Congo	0	Sudan	0
Ethiopia	0	Togo	0
Guinea	0	Uganda	0
Guinea Bissau	0	Yemen	0.016
Haiti	0		

While the TFG was officially established in April of 2004, 2004 is still used as the last period of statelessness to capture the residual effects from those first months as well as to

account for the transition of policy. Because of the persistence of the capital that causes the lights to be visible, the hypothesized result is not one of stark difference in the appearance of light, rather a stagnation or reduction in the growth of the light measurement. As Figure 1 clearly illustrates, after 2004 the gap between the synthetic and true Somalia widens rapidly in a manner consistent with the stagnation hypothesis.

Figure 1: Synthetic Control - Sum Of Lights

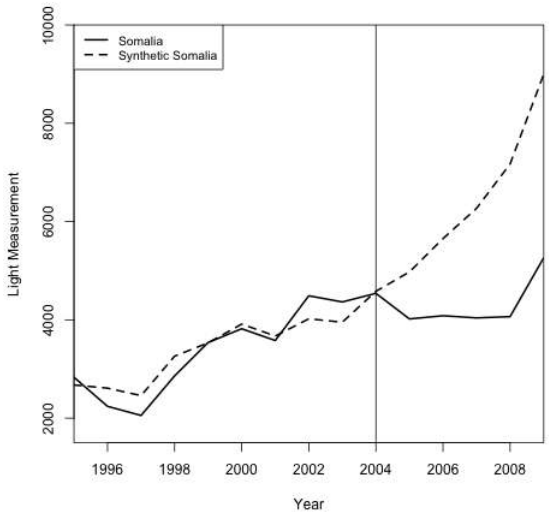


Figure 2: Gaps - Sum Of Lights

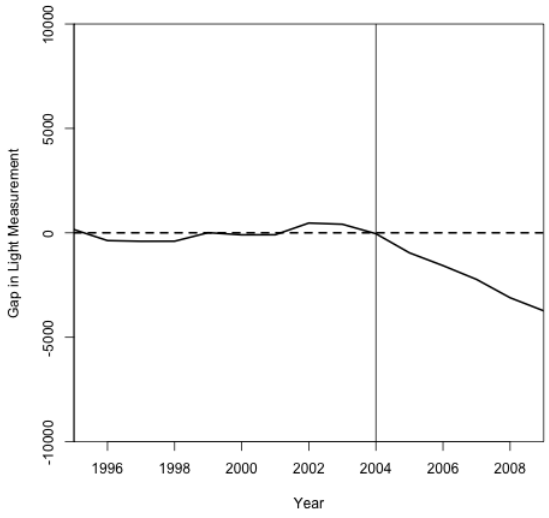


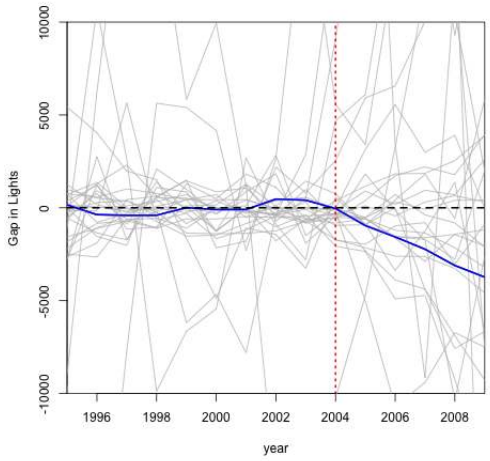
Figure 2 plots the difference between the actual Somalia and the synthetic Somalia,

displaying a clear divergence after 2004. The divergence between the two values appears to depict a scenario where the installation of the TFG led to a stagnation of economic activity that may not have occurred if the country continued to be stateless. This may not be due, directly, to the policies implemented by the government. However, with the introduction of the new government, stability within the country deteriorated. Up through 2006, the southern part of the country fell largely under the informal control of the Islamic Courts Union, as the TFG was attempting to establish itself within country borders. However, just a year later, the TFG began operating within the country and Somalia was assumed to be fully under control of their new internationally recognized government. While the results seem stark, we must be sure that we are not conflating random chance with real effects. To test the difference in the gap between the treated and the synthetic within Somalia, we conduct a placebo test on all the countries in the donor pool as per Abadie et al. (2010).

4.1.1 SOL Placebo Test

The results of the placebo test on the donor pool of LDC countries in the Top 50 of weak and fragile states can be found in Figure 3. This placebo test creates a synthetic for each of the countries in the donor pool.

Figure 3: Placebo Test - SOL



An additional 28 synthetics are depicted in Figure 3. The picture is messy, with many of the countries having large deviations from its synthetic both pre and post-2004. Thus, we restrict the placebo test to only include those countries that have a pre-intervention mean squared prediction error (MSPE) that is no larger than five times the size of Somalia's.

Figure 4: Restricted Placebo Test - SOL

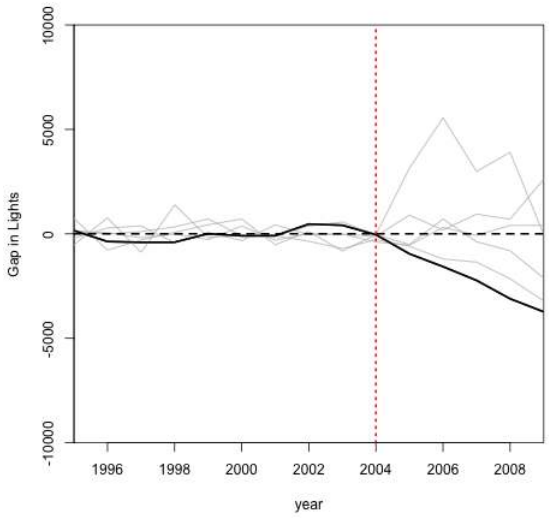


Figure 4 is the result of restricing the placebo test to the 5 countries with a pre-intervention MSPE five times Somalia's or less.[12] It is clear from this figure that Somalia is unique compared to the countries that have a similar fit to Somalia.

4.1.2 SOL MSPE Ratio Test

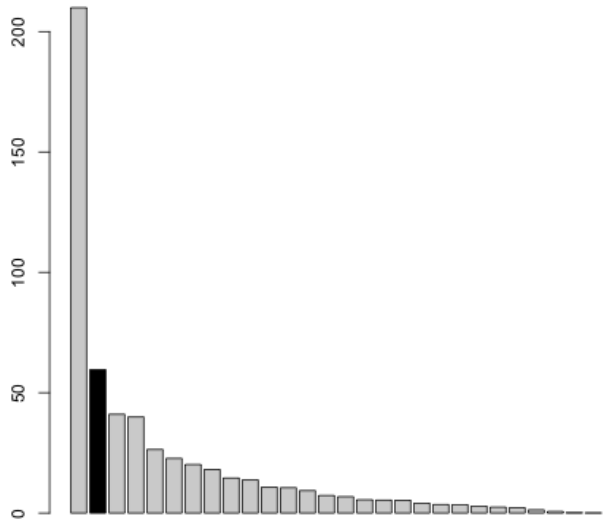
It is important to note that while the picture may be somewhat informative, it lacks statistical rigor. The picture does not allow us to see if Somalia's experience was in fact unique compared to those that were used in the placebo test. To do this, we follow Abadie et al. (2010) and check the ratio of pre-intervention Mean Square Predication Error (MSPE) to that of the post-intervention MSPE. This ratio informs the analysis about the ratio of the fit

[12]For the remainder of the analysis, five times the magnitude of Somalia's pre-intervention MSPE is primarily used. In narrowing the natural log of the sum of lights, we use a more restrictive criteria of only a multiple of two. This is only done as it still retains many of the counties, whereas the multiple of two is too restrictive for our other specifications. Thus, five is primarily used.

between Somalia and its synthetic post intervention, to that of the pre-intervention fit. This ratio ranks the second-highest out of all 27 countries within our donor pool (behind only Angola). In the restricted placebo test, Somalia ranks first out of the remaining countries.

Following Abadie et. al's method, we rank the ratio of the MSPE's for all countries. We then divide the rank of the country by one more than the size of the donor pool, in this case 28. Doing this yields a value of 0.071. This tells us that there is only a 7.1% chance of getting a random result consistent with that of the result we see for Somalia, giving significance just outside of the 5% level for the results. Figure 5 presents the ratio between the MSPE for each country within the donor pool, with Somalia represented by the black bar.

Figure 5: MSPE Ratio Ranking - Sum Of Lights



The story laid out at the outset of this paper seems to be supported by the period of stagnation immediately following the intervention and lasting through 2009. To investigate the potential explanation for economic stagnation as a manifestation of the increase in violence within the country, we present the total number of battle deaths within Somalia for the period of investigation in Table 5.[13]

[13]Data for battle deaths can be found at https://www.prio.org/Data/Armed-Conflict/Battle-Deaths/.

Table 5: Battle Deaths in Somalia, 1995–2009

Year	Total Battle Deaths	% Change
1995	104	-56.12
1996	256	146.15
2001	228	-10.94
2002	114	-50.00
2006	547	379.82
2007	1,546	182.63
2008	1,491	-3.56
2009	1,467	-1.61

Notes: The period of the table is the same period used in the presentation of results, 1995-2009. Missing years are due to no observational record from the data source. The final column of the table presents the percentage change in battle deaths from the previous year. When years are not included, the last included year is used to calculate the percentage change.

Battle deaths increase from 104 in 1995 to 1,467 in 2009, an increase of over 1300% in fifteen short years. The increased hostility in the country made for a more difficult survival, reminiscent of the scenario towards the end of the Barre regime and at the beginning of statelessness, where deaths were 2,710 and 8,005 in 1990 and 1991, respectively.

4.2 Ln(Lights) Synthetic

In order to constrain the results, we take the natural logarithm of the SOL variable investigated in the subsection above. The fit for this synthetic is slightly better than that of the earlier analysis in some variables. The full predictor variable fit between Somalia and the synthetic can be found in Table 6.

Notice that the values for Somalia and the Sample Mean (of all countries in the donor pool) remain unchanged from the previous synthetic, except for the new variable of Ln(SOL). This is because we are using the same set of countries for the donor pool, and the values of Somalia will not be changing as they represent the values for Somalia itself. The full list of countries with the weights for this synthetic can be found in Table 7.

The estimate the authors stated as "best" were the values used.

Table 6: Predictor Fit for Ln(SOL)

Variable	Somalia	Synthetic	Sample Mean
Ln(SOL) (Avg. 1995-2004)	8.10	8.11	9.57
Birth to Death Ratio	3.06	2.89	3.10
Neonatal Mortality Rate	44.44	44.13	42.28
Male Life Exp.	48.65	49.54	51.94
Retail TVA (%)	10.61	10.76	14.82
Mining TVA (%)	3.14	11.49	16.54
Manufacturing TVA (%)	2.47	4.24	9.48
Construction TVA (%)	4.19	3.89	5.20
Transportation TVA (%)	9.53	6.98	6.49
Tuberculosis Rate (Avg. 2002-2004)	285.00	242.06	264.59
% Electricity Access (Avg. 1998-2004)	7.51	16.88	18.95
% Electricity Access (2004)	11.34	19.65	22.07

In this specification, the four countries that contributed to the synthetic in the SOL variation continue to contribute, but in different values. In addition, Haiti and Guinea contribute small weight to the Synthetic. With this, we have six countries that are used to craft our synthetic.

Table 7: Country Weights for Ln(Sum of Lights) Synthetic

Country	Weight	Country	Weight
Afghanistan	0	Laos	0
Angola	0	Liberia	0.396
Bangladesh	0	Malawi	0
Bhutan	0.130	Mauritania	0
Burkina Faso	0	Myanmar	0
Burundi	0	Nepal	0
Cambodia	0	Niger	0
Central African Republic	0	Rwanda	0
Chad	0	Sierra Leone	0.298
Democratic Republic of Congo	0	Sudan	0
Ethiopia	0	Togo	0
Guinea	0.029	Uganda	0
Guinea Bissau	0	Yemen	0.145
Haiti	0.001		

Figure 6 presents the synthetic control for this dependent variable. It appears to depict a similar path as the previous synthetic, though the gaps in both the pre and post-intervention period appear smaller in magnitude. The gaps between actual Somalia and its synthetic are presented in Figure 7.

Figure 6: Synthetic Control - Ln(SOL)

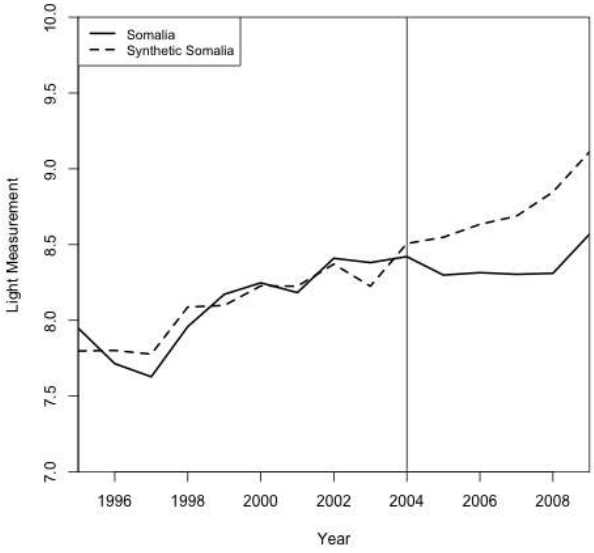
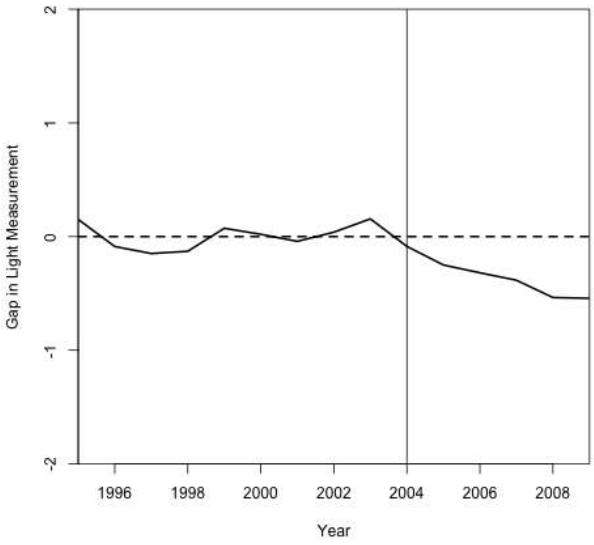


Figure 7: Gaps - Ln(SOL)



4.2.1 Ln(SOL) Placebo Test

Figure 8 presents the full placebo test using all 27 countries within the donor pool for the Ln(SOL) variable. Here, we see the fit for almost all of the countries has improved from the previous specification.

Figure 8: Placebo Test - Ln(SOL)

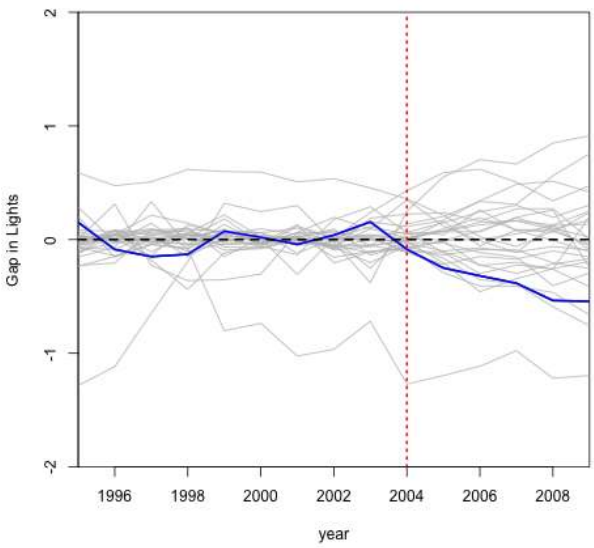
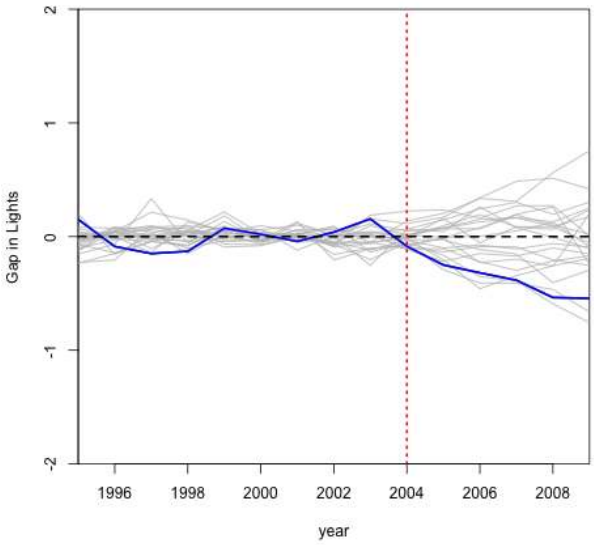


Figure 9: Restricted Placebo - Ln(SOL)



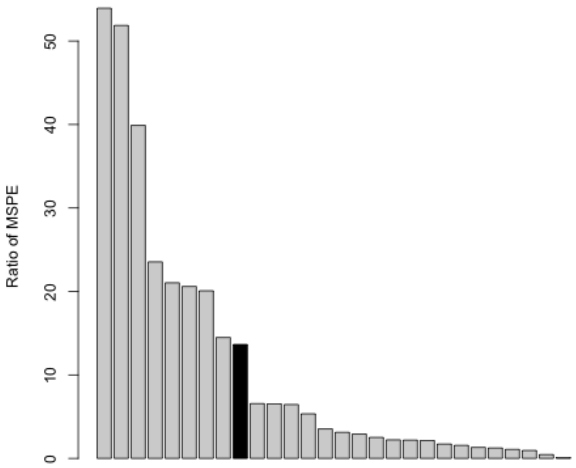
Thus, in our restricted placebo test (Figure 9), we only consider countries that have no more than double the pre-intervention MSPE of Somalia. This removes five countries, and presents the results for the other 22. Here, we can see that Somalia does not appear to separate itself from the other countries post-2004. With this being said, it is important to

remember the potential channels of error that exist within our analysis. Somalia plays home to two independent, though not internationally recognized, states which may be effecting the emission of night lights as they are not subject to the same amount of violence as the southern part of the state. The gap may also be downward biased by the potential of the Mogadishu area emitting far more lights than what should be measured if we are only concerned with economic activity, as it plays home to large refugee camps, military camps, and was the target of direct foreign assistance toward increasing electricity generation (Shortland et al., 2013). These caveats should serve to attenuate the results through a downward bias in the gap between the synthetic and actual Somalia, through artificially high measurements of light emissions within the real country.

4.2.2 Ln(SOL) MSPE Ratio Test

As before, the ratio between the post-2004 MSPE between each actual country and its synthetic is divided by the MSPE of that same country pre-2004. This allows us to rank the growth in distance between the actual country and its synthetic after 2004. This MSPE Ratio Test is presented in Figure 10.

Figure 10: MSPE Ratio Ranking - Ln(SOL)



Somalia does not appear to separate itself from random chance. Somalia (black bar) is ranked 9^{th} out of the 27 countries, thus revealing a 32% probability we could get a result of the same magnitude by random chance. While it appears that Somalia can be shown to be negatively affected by the imposition of the TFG in the natural log of the SOL, we cannot conclude that this result is different from random chance.

4.3 Number of Non-Zero Pixels Synthetic

The third and final specification of the main results is conducted using the number of illuminated pixels within country borders. Each pixel can take on a value between 0-63 and in Somalia there are over 750,000 pixels. For this analysis, each pixel that is emitting some value of light above zero is counted, and we use this sum of non-zero pixels to test for the spread of the light within Somalia.

This raises an important issue. The level of stagnation measured by the SOL may reflect a reduction in the intensity of the light that is being emitted by each pixel, or a decrease in the number of pixels emitting light. That is, there may be fewer areas that are contributing to the SOL measurement.

Table 8: Predictor Fit for Non-Zero Pixels

Variable	Somalia	Synthetic	Sample Mean
Non-Zero Pixels (Avg. 1995-2004)	355.80	359.90	2832.71
Birth to Death Ratio	3.06	2.74	3.10
Neonatal Mortality Rate	44.44	45.66	42.28
Male Life Exp.	48.65	48.50	51.94
Retail TVA (%)	10.61	9.75	14.82
Mining TVA (%)	3.14	6.01	16.54
Manufacturing TVA (%)	2.47	3.19	9.48
Construction TVA (%)	4.19	2.43	5.20
Transportation TVA (%)	9.53	5.72	6.49
Tuberculosis Rate (Avg. 2002-2004)	285.00	264.78	264.59
% Electricity Access (Avg. 1998-2004)	7.51	7.01	18.95
% Electricity Access (2004)	11.34	9.03	22.07

The fit between our synthetic Somalia and actual Somalia is presented in Table 8. It is important to note that the percentage of the population with access to electricity may

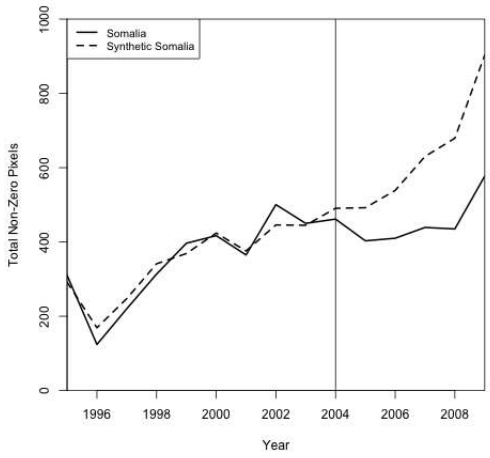
be the most important predictor variable for this specification. Since this variable should capture the number of people who have access to electricity, it should aid in describing the trajectory of the total number of non-zero pixels. This specification provides the most similar fit between the synthetic and actual Somalia. Country weights can be found in Table 9.

Table 9: Country Weights for Non-Zero Pixels Synthetic

Country	Weight	Country	Weight
Afghanistan	0	Laos	0
Angola	0	Liberia	0.647
Bangladesh	0	Malawi	0
Bhutan	0.071	Mauritania	0
Burkina Faso	0	Myanmar	0
Burundi	0	Nepal	0
Cambodia	0	Niger	0
Central African Republic	0	Rwanda	0
Chad	0	Sierra Leone	0.265
Dem. Republic of the Congo	0	Sudan	0
Ethiopia	0	Togo	0
Guinea	0	Uganda	0
Guinea Bissau	0	Yemen	0.017
Haiti	0		

The results of this synthetic are presented in Figure 11. From this, we can see a tight fit between actual and synthetic Somalia pre-2004. Afterwards, the synthetic diverges upwards.

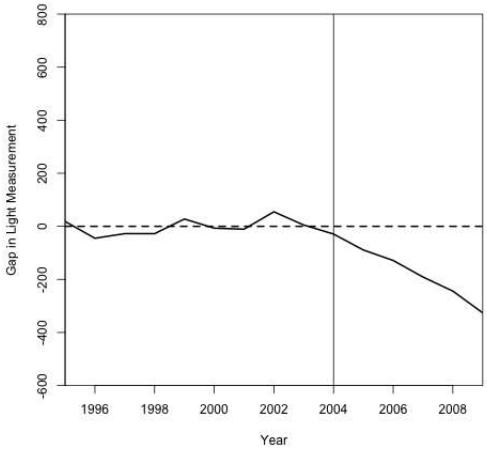
Figure 11: Synthetic Control - Non-Zero Pixels



This suggests that if the TFG was not imposed on Somalia in 2004 they would have likely seen an increase in the spread of light across the country. To put it another way, the TFG

may have affected the ability of rural Somalians to consume electricity at night. The plot of the difference between the actual and synthetic is presented in Figure 12.

Figure 12: Gaps - Non-Zero Pixels



4.3.1 Number of Non-zero Pixels Placebo Test

The full placebo test of all 27 countries in the donor pool is presented in Figure 13. This is once again a challenging picture to understand, with many countries having a very poor fit pre-2004.

Figure 13: Placebo Test - Non-Zero Pixels

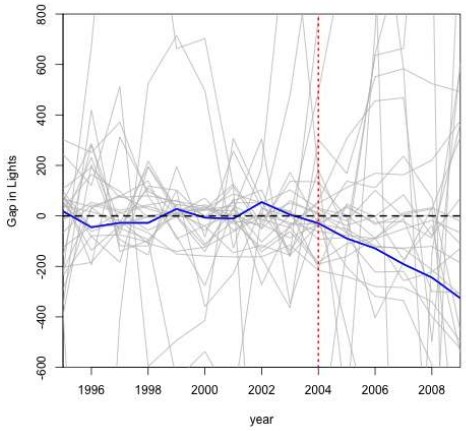
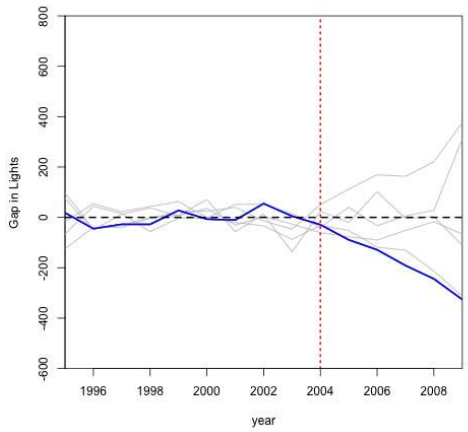


Figure 14: Restricted Placebo Test - Non-Zero Pixels

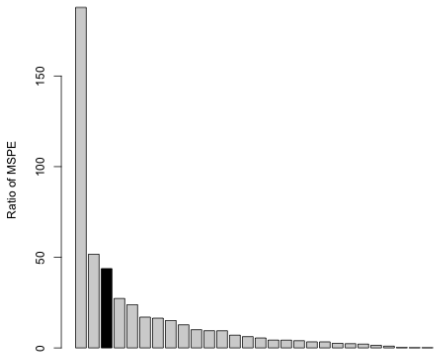


The restricted placebo test in Figure 14 provides a clearer understanding of the behavior of placebo counties prior to and after 2004. Five countries have a pre-2004 MSPE of no more than five times that of Somalia. These five countries are Burundi, Central African Republic, Chad, Liberia, and Rwanda. Here, Somalia does appear to separate itself from the rest.

4.3.2 Number of Non-Zero Pixels MSPE Ratio Test

As with the preceeding analyses, we must see how the ratio between the MSPE before and after the intervention in Somalia compares to the ratio of all other countries within our donor pool. Doing so yields Figure 15.

Figure 15: MSPE Ratio Ranking - Non-Zero Pixels



Here, we see that Somalia is ranked 3rd out of the 28 countries. This translates into a 10.7% probability that we would get a result similar to Somalia's by random chance. However, investigating the two countries that have a higher ratio than Somalia, we see very poor pre-2004 fits (large distance between the synthetic and actual). These countries are Angola and Ethiopia and have a MSPE that is 23 and 67 times larger than Somalia's, respectively.

Figure 16: Restricted Placebo Test (25*Somalia MPSE) - Non-Zero Pixels

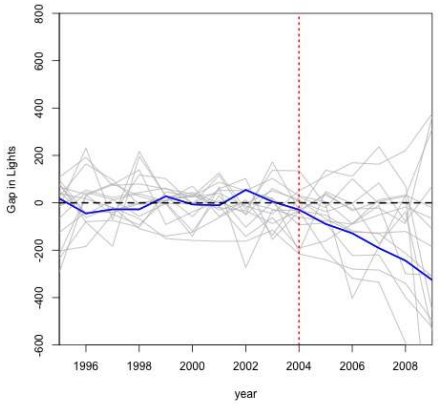
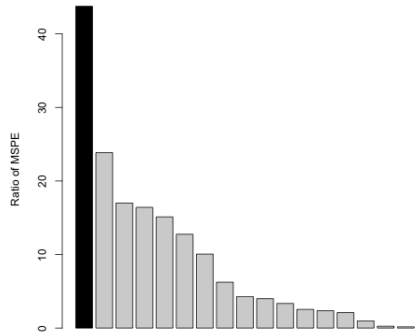


Figure 17: MSPE Ratio Ranking (25*Somalia MSPE) - Non-Zero Pixels



Restricting the placebo test only to those countries that have a MSPE that is less than 25 times that of Somalia moves Somalia to having the largest ratio (out of the remaining 18 countries) and a 5.5% probability of getting those values. The results for this additional

placebo and MSPE ratio test are presented in Figures 16 and 17.

5 Robustness

In this section, additional specifications are explored. Namely, the dependent variable used in Henderson et al. (2012) and Henderson and Kriticos (2018), which adjust the light value for the total area of the country and total number of light emitting pixels, respectively. Following the additional variables, a separate donor pool is used to conduct the analysis. This donor pool includes all countries that are designated as LDC by the World Bank, and the countries that border Somalia are removed from the donor pool.[14] While this is common within the Synthetic Control literature, it may actually pose a problem for the creation of our synthetic, as Somalia experienced a massive drought toward the end of our analysis (Menkhaus, 2009b), something that should be expected to impact the countries that are bordering Somalia as well. While spillover effects may be a concern, it is not likely that Somalia's activity was spilling over to the other countries as they did not have friendly relationships with their neighbors. In the above section, results were presented within their own subsections. Here, the results will be presented all at once for the sake of brevity.

5.1 Ln(SOL by Country Area)

To be consistent with the previous literature using night-light values, we will follow the methods of previous papers. Henderson et al. (2012) use the natural log of the total lights per square kilometer to compare the values of GDP to those created from the light measurements. The fit of the predictor variables for this synthetic can be found in Table 10. As can be seen from the table, this synthetic is the worst fit that we have created thus far. This is most likely due to Somalia being a rather large country (ranked 19th out of 54 African countries) but is in the bottom 10 for the SOL measurement across the donor pool. In addition, the synthetic

[14]These countries are Ethiopia and Djibouti. Recall, Kenya is not in our LDC pool.

is created by fewer countries. Only Chad and Liberia are used to create the synthetic (Table 11).

Table 10: Predictor Fit for Ln(Lights/SQKM)

Variable	Somalia	Synthetic	Sample Mean
Ln(Lights/SQKM) (Avg. 1995-2004)	-4.78	-4.74	-2.34
Birth to Death Ratio	3.06	2.88	3.10
Neonatal Mortality Rate	44.44	45.09	42.28
Male Life Exp.	48.65	47.82	51.94
Retail TVA (%)	10.61	27.36	14.82
Mining TVA (%)	3.14	9.22	16.54
Manufacturing TVA (%)	2.47	3.19	9.48
Construction TVA (%)	4.19	4.35	5.20
Transportation TVA (%)	9.53	5.19	6.49
Tuberculosis Rate (Avg. 2002-2004)	285.00	179.14	264.59
% Electricity Access (Avg. 1998-2004)	7.51	2.40	18.95
% Electricity Access (2004)	11.34	2.58	22.07

Table 11: Country Weights for Ln(Lights/SQKM)

Country	Weight	Country	Weight
Afghanistan	0	Laos	0
Angola	0	Liberia	0.263
Bangladesh	0	Malawi	0
Bhutan	0	Mauritania	0
Burkina Faso	0	Myanmar	0
Burundi	0	Nepal	0
Cambodia	0	Niger	0
Central African Republic	0.737	Rwanda	0
Chad	0	Sierra Leone	0
Dem. Republic of the Congo	0	Sudan	0
Ethiopia	0	Togo	0
Guinea	0	Uganda	0
Guinea Bissau	0	Yemen	0
Haiti	0		

Figure 18 presents the visual of the synthetic for this dependent variable, while Figure 19 explicitly shows the distance between Somalia and its synthetic. As can be seen, the fit for Somalia is very poor in the pre-intervention stage.

Additionally, the placebo test and restricted placebo test are presented in Figures 20 and 21. As can be seen from the presentation of the placebo tests, Somalia fails to differentiate itself from the rest of the pack. This is mainly due to Somalia having a very poor pre-

Figure 18: Synthetic Control - Ln(Lights/SQKM)

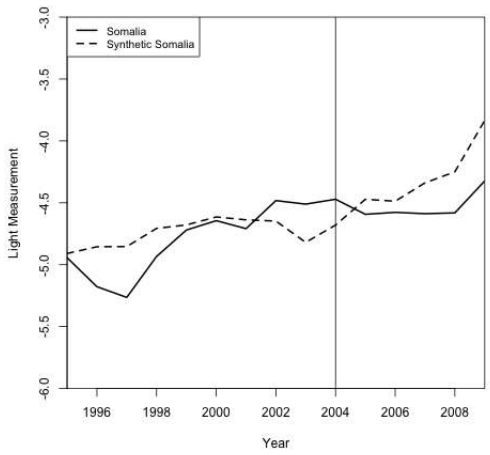
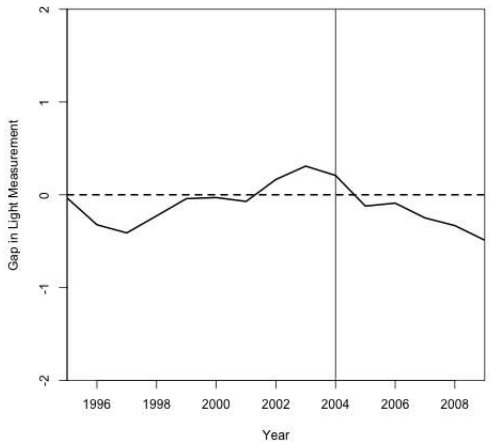


Figure 19: Gaps - Ln(Lights/SQKM)



treatment fit. However, this also translates into a tight post-treatment fit, relative to the other countries in the placebo.

An additional investigation was conducted for the natural logarithm of the SOL divided by the pixels within the country. These results, while not reported, yield a similar non-result. From these tests, it is clear that there may be something that the synthetic control is unable to capture that is effecting the SOL for the country. Somalia produces a uniquely small amount of light for its size, making it hard to get a good fit for the synthetic.

Figure 20: Placebo Test - Ln(Lights/SQKM)

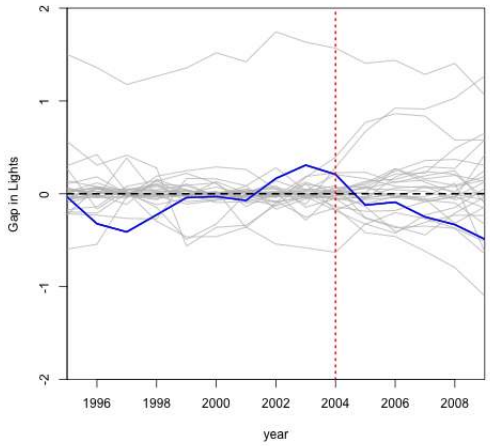
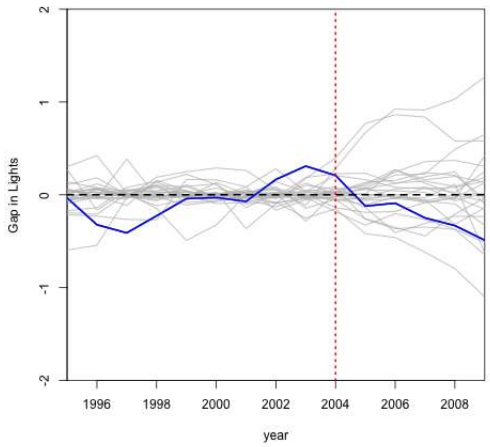


Figure 21: Restricted Placebo Test - Ln(Lights/SQKM)



5.2 LDC Donor Pool

Within the LDC donor pool specification, there are 42 countries that could potentially contribute to the synthetic of Somalia. The large capture of the donor pool is the reason for this not being the primary analysis. In addition, Ethiopia and Djibouti are removed from the potential donor pool countries since they border Somalia. This is an additional robustness check that is included within the changing donor pool.

Table 12 shows the predictor fit between the synthetic and actual Somalia. The rate

Table 12: Predictor Fit for SOL - LDC Donor Pool

Variable	Somalia	Synthetic	Sample Mean
SOL (Avg. 1995-2004)	3,431.76	3,445.98	26,890.00
Birth to Death Ratio	3.06	3.03	3.30
Neonatal Mortality Rate	44.44	44.08	39.06
Male Life Exp.	48.65	51.00	53.04
Retail TVA (%)	10.61	10.64	16.08
Mining TVA (%)	3.14	4.60	16.04
Manufacturing TVA (%)	2.47	3.23	9.82
Construction TVA (%)	4.19	2.04	5.53
Transportation TVA (%)	9.53	5.96	7.45
Tuberculosis Rate (Avg. 2002-2004)	285.00	264.76	280.79
% Electricity Access (Avg. 1998-2004)	7.51	8.63	21.61
% Electricity Access (2004)	11.34	9.97	24.49

of tuberculosis is again the weakest fit. It has the additional caveat of being sensitive to location and population density. We believe, however, that this is a good proxy for healthcare development, humanitarian aid, and overall social well-being within the country. Therefore, we do not omit it from our analysis in this section. With the additional countries, there are seven total countries that contribute to this synthetic (Table 13). As with many of the other specifications, Liberia and Sierra Leone are the largest contributors to the synthetic.

Table 13: Country Weights - LDC Sum of Lights

Country	Weight	Country	Weight
Afghanistan	0.023	Madagascar	0
Angola	0	Malawi	0
Bangladesh	0	Mali	0
Benin	0	Mauratania	0
Bhutan	0	Mozambique	0
Burkina Faso	0	Myanmar	0
Burundi	0	Nepal	0
Cambodia	0	Niger	0
Central African Republic	0	Rwanda	0
Chad	0	Sao Tome and Principe	0.036
Comoros	0	Senegal	0
Dem. Republic of the Congo	0	Sierra Leone	0.123
Eritrea	0	Solomon Islands	0
Gambia	0	Sudan	0.013
Guinea	0	Tanzania	0
Guinea Bissau	0	Timor	0.005
Haiti	0	Togo	0
Kiribati	0.082	Uganda	0
Laos	0	Vanuatu	0
Lesotho	0	Yemen	0
Liberia	0.717	Zambia	0

Figure 22 presents the visual of the synthetic for the LDC donor pool. The figures shows

that the synthetic Somalia continues to see its sum of lights grow post 2004, while actual Somalia flattens. This difference is very clear in Figure 23, which shows the gap between the actual and synthetic Somalia.

Figure 22: Synthetic Control - LDC Sum of Lights

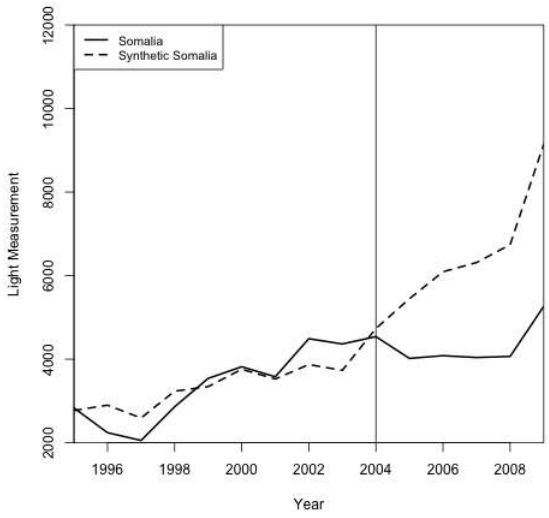
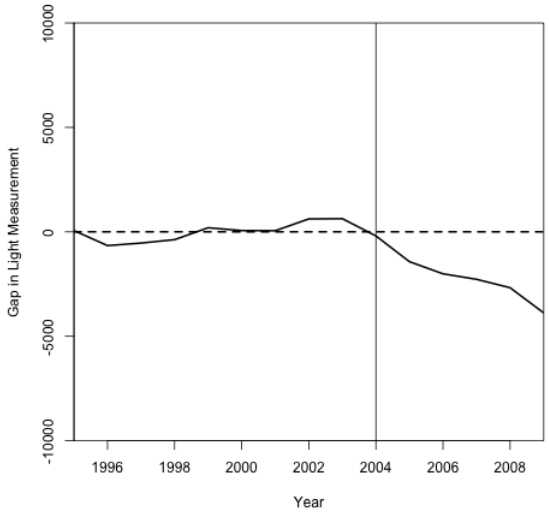


Figure 23: Gaps - LDC Sum of Lights



The placebo test for all 43 countries presented in Figure 24. Somalia has a much closer fit with its synthetic than a majority of the other countries. However, the restricted placebo

test is not included for the sake of brevity. Importantly, the results of the MSPE Ratio Test are presented in Figure 25. Somalia is represented by the black bar that is the third largest ratio between the post and pre-2004 MSPE. This translates into a 6.9% probability of producing Somalia's result by random chance giving the results significance just outside of the 5% level and well below the 10% level.

Figure 24: Placebo Test - LDC Sum of Lights

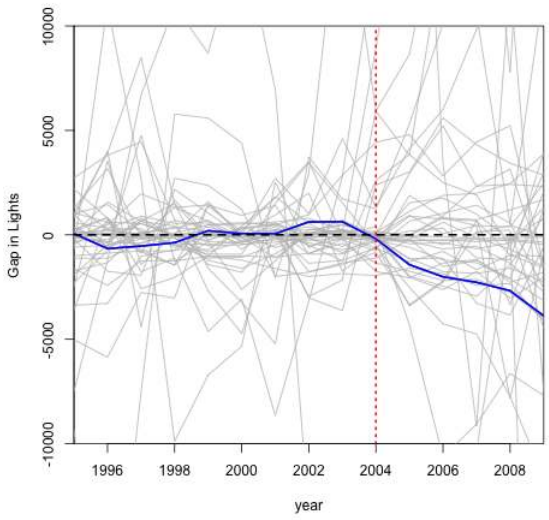
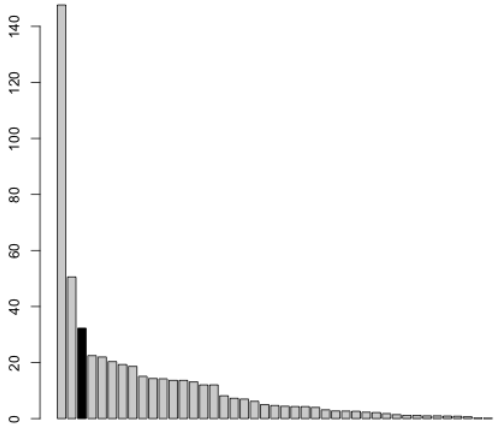


Figure 25: MSPE Ratio Ranking - LDC Sum of Lights



6 Discussion

We discuss the tumultuous political and economic atmosphere experienced by Somalia after the fall of the Barre regime through the attempts to establish an internationally recognized government within its borders. From an oppressive regime from the 1960s until 1991 when it encountered the longest period of statelessness in modern history, to the many failed attempts at establishing a central government within the country, Somalia's experience has certainly been unique. This uniqueness presents problems for studying how any single event effected the country, as many confounding events could be occurring at the same time. With the low nature of development within Somalia and similar countries, data reliability poses an additional problem. We believe the application of night light data is paramount to understanding the development of Somalia in recent years. Our results show that the country began to stagnate immediately following the imposition of the TFG in 2004, until about 2008, when the first President of the TFG, Yusuf, resigned from power. This move seemed to help mend the division that had been created in the country, but the damage had been done. However, leading up to and including 2009, the country experienced rampant violence. UN and Somali officials were the subject of kidnappings and other terrorist attacks that plagued important or otherwise highly trafficked areas of the country. This period of violence led the country to be designated the worlds worst humanitarian crisis at the time (Menkhaus et al., 2009). This creates suspicion around the increase in night light emissions during this period. There is potential that this result could be seen from an increase in camps that were being created to help house those who were displaced, or other channels of intergovernmental intervention led by AMISOM forces entering the capital (Menkhaus, 2009a).

Our results suggest that there has been some economic decline, or at the very least economic stagnation due to the TFG taking power within the country. The lack of data reliability for the countries in our donor pool, as well as our country of interest, makes it difficult to fit a good match in the pre-intervention period for all of the countries. However,

since the only reliable proxy we have is for the economic activity, the other measurements collected by international organizations must be used if this question is to be investigated at all.

The results for Somalia are mixed across the various dependent variables used. For the total light emissions within the country (SOL) we have significance in our primary and robustness donor pools. However, when investigating more sensitive results, we are unable to assert that the results we are experiencing are from something more than random chance. This fact is occurring in part from the inclusion of the unofficial independent states within the country increasing the night light emissions and the questionable data reporting that occurred during Somalia's period of statelessness when these measurements would certainly be difficult to capture with any sort of confidence. For the purposes of this study, there is nothing that could be done to capture more reliable measurements of our predictor variables, particularly for the pre-intervention period. While there has been mention of potential upward bias in the magnitude of night light emissions in the country for the post-intervention period, these would most likely only act to understate the gap between the synthetic and true Somalia.

Table 5 presents that total battle deaths within Somalia from the beginning of statelessness until the end of our sample.[15] The numbers present a troubling story. Prior to the TFG, Somalia was experiencing relative peace since the violent years of 1990-1992 (directly before and at the start of statelessness). However, since that period, Somalia had not seen battle deaths increase above 256. In 2006, two years after the TFG became the official government of Somalia, battle deaths reached the highest point since 1992. This trend continued further, with Somalia experiencing over 1,000 deaths associated with violent conflicts throughout the rest of the sample period. This result seems to be corroborated by the aforementioned narratives into life in Somalia post-TFG, and are most likely the cause of the economic stagnation we see in our synthetic control.

[15]Data for battle deaths can be found at https://www.prio.org/Data/Armed-Conflict/Battle-Deaths/. The estimate the authors stated as "best" were the values used.

The resulting violence around the implementation of the TFG is the likely candidate for the cause of a slowdown in economic activity, not necessarily the policies or actions of the government itself. The country had long been operating under informal systems of law and dispute resolution prior to their colonization by the British and Italians and the "unified" country that resulted. Considering the informal structure of societies should be a top priority of state-building agents and intervening international organizations. Path dependence which has surely resulted from centuries of informal operation can create an incongruity between social norms and the formal governance structure imposed. If these two systems are divergent enough, violence may be widespread as some groups attempt to gain control over the others, due to the fear that they do not want to be the ones lacking power.

The process of state-building is surely a difficult one, and with Somalia being one of the first countries to experience anything such as this in the modern era, there were sure to be blunders. While understanding the effect of these interventions is important, it is but one piece to the puzzle of how to solve these crises, and to suggest that this piece alone warrants policy prescriptions would be a fool's errand.

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