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COVID-19: Early evening curfews and mobility

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Abstract

During the COVID-19 pandemic, some countries introduced early evening curfews. Several studies try to measure the effectiveness of such measures across different countries, but disentangling competing effects can be elusive. We examined the impact of an early evening curfew on mobility by studying a shift in curfews from 9pm to 6pm in Greece using Google mobility data. We followed a difference-in-difference (DiD) econometric approach, where we compared trends in mobility in residential spaces as well as groceries and pharmacies, before and after the introduction of the 6pm curfew in Attica with trends in three other comparable Regions. We found little or no evidence of an effect of the early curfew on daily mobility relating to groceries and pharmacies, and that a 18.75% reduction in hours where people were allowed to leave home led to a relatively small increase in time spent in residential spaces. This less-than-proportionate reduction in mobility outside the household suggests a possibility that the curfew led to *more* people coinciding in indoor public spaces, such as grocery shops – which constitutes a contagion risk factor. Results should be treated with caution, especially with regards to the magnitude of any effect, as Google mobility data do not report the time of the day, so the time density of activities cannot be estimated. Lockdowns and other measures are necessary to tackle Covid-19, but it is important to avoid substitution by activities that contribute further to spreading the virus. Interventions should therefore be based on a thorough analysis of human behaviour.

Keywords: Covid-19; mobility; curfews; non-pharmaceutical interventions; substitution

1. Background

There is an ongoing debate about non-pharmaceutical interventions and how effective they are in tackling the COVID-19 pandemic (Brauner et al 2021). Such measures are most often introduced jointly, so disentangling the competing effects of individual measures is challenging. Common measures that are introduced jointly include restrictions of movement, congregation and closures, for example of (a) schools and shops at the same time, (b) bars and restaurants (often closing both outdoors and indoors), or both (a) and (b). Governments normally treat these measures as substitutes (e.g. stating that other measures such as curfews or restaurant closures would remain in place to allow re-opening of schools, which was seen as a priority), although potential complementarities between some of them cannot be ruled out. Finding appropriate control groups to disentangle the effects of individual measures is not straightforward.

An increasing number of studies suggest that the stringency of the lockdown measures does not always make a difference in infection prevalence or related deaths (e.g. Bonardi et al 2020 argue that that partial lockdowns were as effective in reducing the number of infections and deaths as stricter measures). Of course, such studies are often challenged by measurement and identification issues (Goodman-Bacon and Marcus 2020). Also, there are examples of evidence that the 'signal' (inducing voluntary behavior changes) is important in contrast to the actual regulation (mandated behavior changes) (Herby 2021). In general though, restricting one human activity often leads to substitution by others, as humans seek alternatives, and there may be a strictness level beyond which extra measures can actually backfire. In this paper we suggest that early curfews may be one of these cases, where excessive strictness might potentially lead to the opposite of the intended epidemiological result.

Why would reducing the time window during which people are allowed to leave their homes either fail to achieve the desired greater reduction in virus spread or, even, backfire by contributing towards the spread? One straightforward reason is that people do not fully reduce the activity proportionately to the strictness of measures – they reallocate part of it towards options that are still allowed. For example, mobile tracker data in the US shows a large reallocation of consumer activity from "nonessential" to "essential" businesses (note that definition of essential varies by country) as well as from restaurants and bars toward groceries and other food sellers (Goolsbee and Syverson 2021). Whilst overall the pandemic appears to have caused a change in online consumption patterns (Alvarez et al 2021) and the response of consumption to government stimuli (Chetty et al 2020), it would seem that essential consumption persisted at reasonable levels. Supermarkets, for instance, have been linked to higher likelihood of spreading the disease (Shao et al 2021). These studies do not measure the resulting congestion in the essential businesses, but this is likely to be high, resulting in greater risk of virus spread. Importantly, recent studies show that early evening curfews backfired in Toulouse (Dimeglio et al 2021), had no effect in Hesse (Haas et al 2021) and may elicit reactance (Sprengholz et al 2021).

In our study, we took advantage of within-country heterogeneity in the timing of the introduction of an early evening curfew to evaluate this measure in tackling the Covid-19 pandemic.

Our study focuses on the impact on mobility rather than disease outcomes. In other words, we study how curfews affect a Covid-19 risk factor (mobility, which may be associated with crowding) instead of Covid-19 cases or deaths. We followed this approach for a number of reasons. Linking COVID-19 cases with a particular intervention is particularly challenging and may be misleading due to the presence of different

variants; there is dispersion in the time lag between infection and death; second-hand transmission may occur via asymptomatic people; and there is a strong time-varying bias in disease measurement, whether it is done by recorded cases or by test positivity rates (Georganas et al 2021).

While cross-country studies are very useful, they suffer from several drawbacks absent in our method. On the one hand countries differ in important characteristics that affect the performance of measures (availability of ICUs, the state of the health system), but crucially they also differ in the way they measure the pandemic itself. Recorded cases are biased and since testing methods are not homogeneous across countries, the bias is heterogeneous, differing greatly across countries (Georganas et al 2021). On the other hand, the measures are not the same across countries, and are seldom enacted alone within a specific country. Usually, a complicated bundle of measures is enacted on the same day (and some measures almost always come together, such as closing several levels of schooling along with other face-to-face activities) which greatly complicates isolating the effect of a single measure. In this paper we use evidence from a single European country to examine the effect of early curfews, using a difference-in-differences approach, comparing a region affected by the curfew to other regions.

2. Data and Methods

While a 9pm-5am curfew applied in Greece since November 2020, a 6pm-5am *weekend* curfew was introduced on 6 February 2021 in the Attica region (which includes the capital city of Athens) as a response to increasing Covid-19 cases. The reason for the stricter curfew time was related to rising COVID-19 cases and hospitalisations, despite the existing social distancing measures and the 9pm curfew. These were attributed to too much movement in public areas in Athens, with concerns that people were meeting

outdoors or paying a visit family and friends, and hanging out around coffee shops and bars offering drinks to go. Banning movement after 6pm on weekends, when many people don't work, directly affected their options to meet with others – but it also reduced the hours of the day that they could engage in activities, such as visiting grocery stores. Commuting to and from work was exempt from the curfew, but businesses that would normally have customers after 6pm would be directly affected (the government took separate financial measures for businesses and individuals affected by Covid-19 non-pharmaceutical interventions). We studied the impact of the 6pm curfew on human activity using mobility data from Google COVID-19 Community Mobility Reports (2021) over the period of 2 January – 28 February 2021.

2.1 COVID-19 Community Mobility Reports Data

Google mobility reports show daily-level movement trends by region, across different categories. These reports use aggregated, anonymized data from users who have turned on the Location History setting, The same kind of data are used to show popular times for places in Google Maps (Google COVID-19 Community Mobility Reports 2021). The category labels are: retail and recreation, groceries and pharmacies, parks, transit stations, workplaces, and residential. The residential category is measured in amount of time spent, while the other four categories are measured in number of visitors.

The data show the percentage change in visitor numbers to (or time spent in) categorized places compared to the baseline. According to the data source, each day's baseline is the median day-value for the corresponding day of the week, from the 5-week period Jan 2 – Feb 6, 2020 (before COVID-19 measures were introduced).

We use the raw daily percentage change from the baseline as our outcome variable. In particular, we focused on time spent at residential spaces, and time spent at groceries/pharmacies. Staying at home is considered a goal of lockdown measures, to limit the spread of the novel coronavirus; and it has been shown that indoor spaces such as supermarkets may facilitate transmission (Shao et al 2021). We considered the weekend mobility figures, since this is when the curfew policy differed between regions. Further details on the specifics of the dataset can be found in the Online Appendix.

Apple mobility trends reports are also available. However, these only cover driving, walking and commuting, and capture the volume of *requests*, rather than actual mobility. Furthermore, Apple makes data available for Attica and Greece as a whole only, so the control group would include the treatment area. Despite these issues, any evidence we could get out of the Apple data points at exactly the same direction as the results using the Google data.

2.2 Difference-in-Differences Analysis

A simple before-after analysis to evaluate the impact of the policy on mobility in Attica may not be reliable as other factors affecting mobility may change, which is why we used control groups: one in the main analysis (the Aegean Region) and two for additional robustness checks (the Epirus & Western Macedonia Region; and the Thessaly & Central Greece Region). Figure 1 provides a map of the Regions of Greece.

We studied the difference in the differences in mobility between Attica and the control regions in the five weekends before (all weekends in January) and the four weekends after (all weekends in February) the introduction of the 6pm curfew in Attica using a difference-in-differences (DiD) ordinary least squares econometric estimator. A DiD model compares trends in the outcome in the treatment group and a control group

before and after a particular intervention, and is used extensively in the literature for causal inference (Kavetsos et al 2021; Autor 2003). In such empirical models, there is a treatment group dummy, which takes the value of 1 for the group that underwent a treatment; and a treatment period dummy, which takes the value of 1 for the time after the intervention. The interaction of the treatment group dummy and the treatment period dummy gives us the main variable of interest.

[Insert Figure 1 here]

Finding an appropriate control group can be challenging. Some localised 6pm curfews did apply to small parts of the population in sub-areas of these control regions depending on local increases in COVID-19 cases in villages or towns, so our control groups are not absolutely perfect. However, we argue that these can still serve as appropriate control groups (see Figure 2 for visual inspection of trends). In the Aegean region, 13.2 % of the population on average was subject to a local 6pm curfew before this applied to the whole Attica Region, and 12.3% afterwards. As this applied to a small part of the population, and the percentage remained about the same, we argue that this can be used as an appropriate control group for our study.

[Insert Figure 2 here]

We repeated the analysis using two additional control groups (separately, and within a single regression), which are perhaps not as suitable as the Aegean region, but still useful as a robustness check. 15.7% of the population on average in Epirus & Western Macedonia was subject to local 6pm curfews before the introduction of the measure in

Attica, which decreased to 6.7% afterwards. This reduction in proportion of local populations under curfew could lead to an overestimate of any reduction in mobility in Attica, or of time spent in residential places. The corresponding figures in Thessaly & Central Greece were 6.8% on average before and 19.9% after, demonstrating a relative increase in proportion of local population under lockdown. Using this region as a control group may lead to an underestimate of any reduction in mobility in stores in Attica or of time spent in residential places.

In the DiD model, the dependent variable is the percentage change in time spent in a particular type of location compared to the baseline. In one model we study groceries and pharmacies, and in the other we study residential spaces. We included a dummy variable for the Attica region which is the treatment group (1 for observations on Attica and 0 for the control group), and a dummy variable which takes the value of one in the post-treatment period (from 6 February onwards) and zero otherwise. The interaction between the two shows whether the intervention had an effect on relative trends. We used robust standard errors in regressions. Summary statistics are presented in Table 1.

[Insert Table 1 here]

Figure 2 shows the trends in mobility in the treatment and control regions before and after the 6pm curfew intervention. What matters in a DiD model is that the control and treatment groups demonstrate common trends. A visual observation of the graphs suggests the presence of similar trends in mobility with regards to groceries and pharmacies (Panel A), and residential spaces (panel B) – although this is not directly testable. The trends in other related variables such as daily case counts and deaths over the period of study can be found in the Appendix (Figures A1 and A2). Of course, Attica

includes the capital city of Athens, and in that sense is more urban than the control groups. Nevertheless, control groups are often different than treatment groups, and what matters is the relative change rather than the absolute characteristics. For example, different countries or US States with different characteristics have been used in the literature when performing DiD analyses (Kavetsos et al 2021; Kim and Albert Kim 2018; Card and Krueger 1994). In any case, an assumption of this analysis is that in the absence of the 6pm curfew in Attica, the trends between Attica and control regions would remain similar (and we have no reason to believe that something other than the 6pm intervention coincided with the treatment and would have distorted the common pre-treatment trends).

On top of the traditional DiD which basically averages between treated and non-treated periods and regions, we take advantage of the recent advancements in econometrics, applying synthetic DiD (SDiD) to our data (Arkhangelsky et al 2018). The primary difference is that it allows to construct the control by putting differential weights on both control units (regions) and pre-treatment time periods – rather than averaging over them as the standard DiD model would. The goal of the differential weighting is to match the pre-treatment trend of the treated region as closely as possible using the weighted combination of controls – and then use the same weights to extend the trend into the treatment period. The literature offers an a-theoretic selection tool for such weight selection, where the model automatically selects the combination of control regions and periods that best matches the pre-treatment trend in Attica.

3. Results

The results of the DiD regressions using the Aegean region as a control are presented in Table 2. When considering the effect on time spent in groceries and pharmacies (column

1), the coefficient of the DiD interaction term, that shows the difference in the difference between the two regions, is statistically insignificant [coeff: -13.55; 95%CI -42.723 to 15.623]. This suggests that there was no change in the relative trends in visits to groceries and pharmacies in Attica compared to the control group after the intervention. Column 2 shows the results of the model with time spent at residential spaces as outcome. The DiD interaction term is positive and statistically significant [coeff: 4.4; 95%CI 1.688 to 7.112], suggesting that the relative increase in time spent at residential spaces after the 6pm curfew was only 4.4 percentage points. The results of the econometric analysis show that a reduction in the time when people were allowed to go outside by 3 hours (a 18.75% decrease) led to a 4.4 percentage point increase in time spent at home and had no effect on time spent in groceries or pharmacies, in relative terms.

[Insert Table 2 here]

Three robustness checks using two more Regions as control groups (separately, and in the same regression with the Aegean) confirm the results of the main analysis. We get similar results when using the Epirus & Western Macedonia Region as control group (Table A1, Online Appendix). The model examining mobility in groceries and pharmacies yields statistically insignificant results, as in the main model, and in the model examining time spent residential spaces, the DiD coefficient is positive and statistically significant [coeff: 4.625; 95%CI 1.412 to 7.838], but slightly larger than in the main model, as expected. Table A2 in the Online Appendix presents the DiD results of the model using Thessaly as a control group, as well as all three regions as controls (Table A3). When studying the effect on mobility relating to groceries and pharmacies, the coefficient of the DiD interaction term remains statistically insignificant, as in the main analysis. In the

model studying residential spaces, the DiD interaction term is positive but statistically significant at the 10% level only, with a smaller magnitude than in the main analysis, as expected [coeff: 3.025; 95%CI -0.275 to 6.325]. As discussed above, this can be expected given that Thessaly had a larger proportion of population under curfew than the other control groups. The regression including all three regions as control gives consistent results (Table A3 in the Appendix). Additionally, we conduct a robustness check with the inverse hyperbolic sine transformation applied to the dependent variables, obtaining estimates highly consistent in direction and significance with those reported above (Tables A4 and A5 in the Appendix). Results using synthetic controls (SDiD), which are in the same direction as the results of the baseline model, are presented in the Online Appendix (Section A1 and Figures A3 and A4).

4. Discussion

We found that the 6pm instead of 9pm curfew in Athens appears to have led to a 4.4 percentage point relative increase in time spent at home and had no effect on time spent in groceries and pharmacies. Considering that this was a result of a 18.75% reduction in hours where people were allowed to leave home, and the percentage change in mobility seems to be smaller than the percentage change in time, the early curfew may have led to greater crowding. Especially with regards to grocery stores, the same level of mobility appears to be concentrated in fewer hours of the day. If more people were present simultaneously in high-risk places such as supermarkets (instead of being spread over more hours during the day), the curfew may have led to greater disease transmission. The percentage increase in time spent at residential spaces was lower than the percentage change in time permitted to leave home due to the curfew. Apparently,

following the introduction of the 6pm curfew, people did not reduce their activities proportionately to the time that they were allowed to leave home.

Finding the exact impact is not straightforward, as Google mobility data do not show at what time of the day these activities took place, or the density of activities during the day. Of course, not all hours in the day demonstrate the same level of mobility, so this 18.75% reduction in hours when people were free to leave their homes does not reflect differences in density.

Our findings add to important existing evidence from Toulouse (Dimeglio et al 2021) that suggests that a 6pm curfew backfired, and to a paper on the German *Land* of Hesse that found no evidence that night curfews had an effect on disease transmission (Haas et al 2021). Another recent study argues evening curfews may elicit reactance (Sprengholz et al 2021). Interestingly, we find little or no evidence of a decrease in mobility at essential businesses such as groceries and pharmacies despite the lower number of hours that people could spend in stores. This is broadly in line with Chetty et al (2020) finding of the lower income households increasing consumption in response to government stimulus.

The outcome variable in this study is mobility rather than infections. Although certain environments such as supermarkets have a higher likelihood of spreading the disease (Shao et al 2021), our data do not show the actual impact on Covid-19. However, such an effect would be extremely challenging to disentangle, even with clinical data for the following reasons: (a) Other factors such as variants that may be more transmissible may apply, distorting the effect on actual health outcomes; (b) there is dispersion in the time lag between infection and symptoms or hospitalisation or death; (c) the effect might show via second-hand transmission (for example, individuals who first contract SARS-CoV-2 may be younger people who are often asymptomatic (Kelvin and Halperin 2020),

and may pass the virus on to others with a longer lag); (d) due to bias in disease prevalence measurement (Georganas et al 2021). Future research can examine the complicated relationship between curfews, mobility and COVID-19 cases at the regional level, taking into account the aforementioned empirical challenges.

Aside of challenges to measurement, evaluating effect of counter-Covid-19 measures on cases is sensitive to factors undermining the validity of estimates, such as effects driven by anticipation of measures, reverse causality, and spillovers (Goodman-Bacon and Marcus 2020). Indeed, it is very plausible that people may change behaviour in response to factors other than governmental restrictions, such as case counts. Note that in our case this would lead to an underestimate of the effect of the curfew, as follows. If rising cases in Attica (treated) region led people to staying at home more and avoiding indoor public spaces (such as grocery shops and pharmacies) – what we are estimating is a joint effect of the curfew (law) and rising cases (fear). Should the curfew be effective, we would see reduction in mobility outside the residence *greater than proportionate* to the decrease in time allowed. We also consider an alternative possibility, where rising cases in the control regions would motivate people to stay at home more *despite* the lack of governmental intervention in form of curfew. This would lead to a smaller difference in mobility between treated and control regions, but attributable to fear, rather than to the effect of the curfew.

This study is subject to limitations. We cannot directly calculate the impact on crowding as Google mobility data are not available by time of the day – so the magnitude of any reported effect should be interpreted with caution. For example, while we do not find a sufficient overall decrease in mobility, it may have decreased more in some parts of the day (e.g. early mornings) with majority of outdoors mobility (and the resulting crowding) concentrating in later part of the day (e.g. just before grocery stores close).

Nevertheless, daily averages are still informative. Furthermore, as discussed, small parts of the population in control groups lived in sub-regions that were subject to local lockdowns. It is also worth mentioning that many stores are closed on Sundays. Finally, our study focuses on mobility rather than infections.

We were not able to consider smaller geographic areas due to data availability constraints, and we also do not have any information on purchases made – which may have been affected by the pandemic (Alvarez et al 2021). Future research can take purchasing behaviour into account, if such data become available.

Whilst Google mobility data have been used by multiple studies (including comparison of mobility trends between and within countries, Chan, 2020; evaluation of social distancing on regional levels within countries, Cot et al 2021; Wielechowski et al 2020; nowcasting economic activity, Sampi Bravo and Jooste, 2020) - the absence of disclosure by dataset owners of the proportion of smartphone users whose location history is recorded, is a weak point of this literature. As a consequence, our ability to assess the representativeness of this subset of population is limited. However, note that Google's policy for anonymising the data results in gaps on the days which lack "enough data to confidently and anonymously estimate the change from the baseline" – which is also a median value over a 5-week period (see Appendix for details on the dataset). Since there are no such gaps for any of the regions of Greece over the period of interest, we are confident that the dataset captures a substantial proportion of the population.

Our findings are relevant to areas that are still fighting COVID-19 but also to the next pandemic or any contagious disease (e.g. Ebola). Overall, non-pharmaceutical interventions were necessary to tackle Covid-19, but any measures should be carefully designed and should be based on a thorough analysis of human behaviour, that anticipates substitution of activities. Decisions on what sort of interventions are

introduced should be based on empirical evidence, and constantly re-evaluated and adjusted when necessary to prevent backfiring. It seems that some measures can occasionally be *too* strict, even if containing the disease is the only goal.

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Online Appendix

Table A1 – Robustness Check: Using Epirus & Western Macedonia Region as control group

	grocery & pharmacy	residential
DiD interaction term (Attica*week 6 onwards)	-9.95	4.625***
	[-44.358 - 24.458]	[1.412 - 7.838]
Week 6 onwards (treatment period)	1.725	-4.20***
	[-23.336 - 26.786]	[-6.668 - -1.732]
Attica dummy variable (treatment group)	-2.30	1.00
	-66.904	[-1.086 - 3.086]
Constant term	3.90	11.2***
	[-20.211 - 28.011]	[9.948 - 12.452]
Observations	36	36
R-squared	0.0282	0.4825
F-statistic	3.37	7.71

The dependent variable is the change in time spent in the two types of locations compared to the baseline. Robust 95% confidence intervals in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table A2 – Robustness Check: Using Thessaly Region as control group

	grocery & pharmacy	residential
DiD interaction term (Attica*week 6 onwards)	-5.75	3.025*
	[-39.015 to 27.515]	[-0.275 to 6.325]
Week 6 onwards (treatment period)	-2.475	-2.6**
	[-25.942 to 20.992]	[-5.180 to -0.020]
Attica dummy variable (treatment group)	0.5	1.60
	[-30.627 to 31.627]	[-0.517 to 3.717]
Constant term	1.1	10.6***
	[-19.667 to 21.867]	[9.297 to 11.904]
Observations	36	36
R-squared	0.016	0.372
F-statistic	0.56	5.49

The dependent variable is the change in time spent in the two types of locations compared to the baseline. Robust 95% confidence intervals in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table A3 – Robustness Check: Results of the Difference-in-Differences regressions, using three regions (Aegean; Thessaly & Central Greece; Epirus & Western Macedonia) as a control group

	grocery & pharmacy	residential
DiD interaction term (Attica*week 6 onwards)	-9.75	4.017***
	[-35.301 to 15.801]	[1.614 to 6.420]
Week 6 onwards (treatment period)	1.525	-3.592***
	[-10.753 to 13.803]	[-4.989 to -2.195]
Attica dummy variable (treatment group)	1.167	1.900**
	[-23.609 to 25.943]	[0.149 to 3.651]
Constant term	0.433	10.300***
	[-10.890 to 11.757]	[9.556 to 11.044]
Observations	72	72
R-squared	0.011	0.478
F-statistic	2.67	19.64

The dependent variable is the change in time spent in the two types of locations compared to the baseline. Robust 95% confidence intervals in brackets. *** p<0.01, ** p<0.05, * p<0.1.

Table A4 – Robustness Check: Applying the inverse hyperbolic sine (IHS) transformation to the dependent variable (residential)

	Dependent variable:		
	Time spent in residential locations (IHS)		
	Aegean	Epirus and Western Macedonia	Thessaly and Central Greece
	(1)	(2)	(3)
DiD interaction term (Attica*week 6 onwards)	0.65***	0.56***	0.37**
	(0.36, 0.95)	(0.26, 0.87)	(0.06, 0.69)
Week 6 onwards (treatment period)	-0.61***	-0.52***	-0.33***
	(-0.81, -0.40)	(-0.74, -0.30)	(-0.55, -0.10)
Attica dummy variable (treatment group)	0.29***	0.08	0.14
	(0.09, 0.48)	(-0.13, 0.28)	(-0.08, 0.35)
Constant term	2.89***	3.10***	3.04***
	(2.75, 3.03)	(2.95, 3.24)	(2.89, 3.19)
Observations	36	36	36
R^2	0.75	0.56	0.41
Adjusted R^2	0.72	0.52	0.36
F Statistic (df = 3; 32)	31.22***	13.40***	7.51***
Note:			*p<0.1; **p<0.05; ***p<0.01

Table A5 – Robustness Check: Applying the inverse hyperbolic sine (IHS) transformation to the dependent variable (groceries)

	Dependent variable:		
	Time spent in groceries and pharmacies (IHS)		
	Aegean	Epirus and Western Macedonia	Thessaly and Central Greece
	(1)	(2)	(3)
DiD interaction term (Attica*week 6 onwards)	-2.36	-2.67	-1.48
	(-6.14, 1.42)	(-6.55, 1.20)	(-5.67, 2.72)
Week 6 onwards (treatment period)	0.68	0.99	-0.21
	(-1.99, 3.35)	(-1.75, 3.73)	(-3.17, 2.76)
Attica dummy variable (treatment group)	-0.13	-0.67	-0.40
	(-2.66, 2.39)	(-3.25, 1.91)	(-3.20, 2.39)
Constant term	-0.22	0.31	0.04
	(-2.01, 1.56)	(-1.52, 2.13)	(-1.93, 2.02)
Observations	36	36	36
R^2	0.09	0.15	0.07
Adjusted R^2	0.01	0.07	-0.02
F Statistic (df = 3; 32)	1.10	1.84	0.75
Note:			*p<0.1; **p<0.05; ***p<0.01

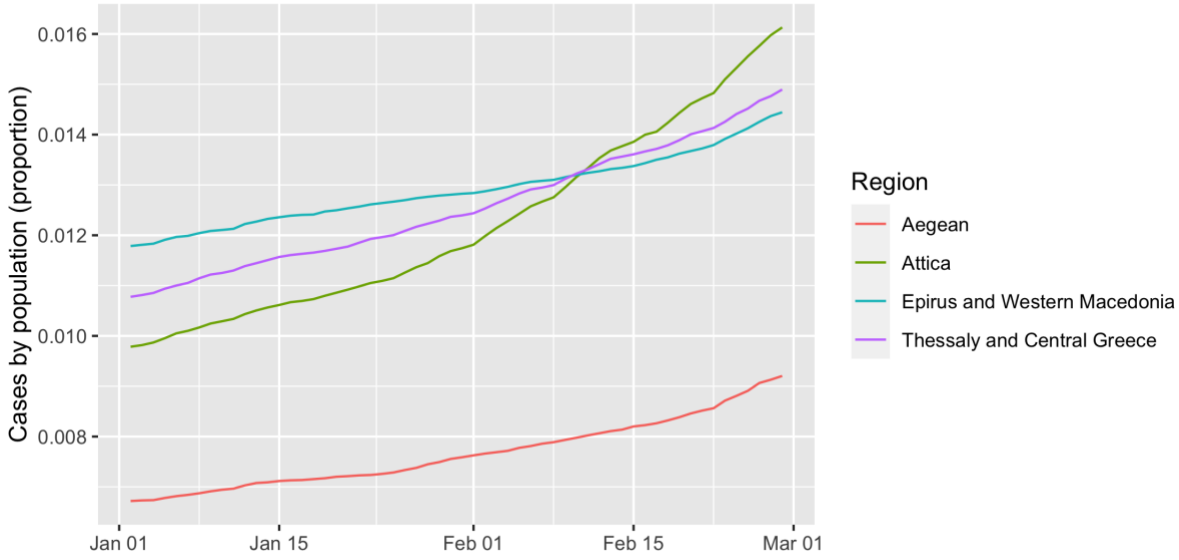


Figure A1 – Trends for Covid-19 case counts (total cases divided by region's population) in the regions of Attica (treated) and (1) Aegean, (2) Epirus and Western Macedonia, and (3) Thessaly and Central Greece (controls).

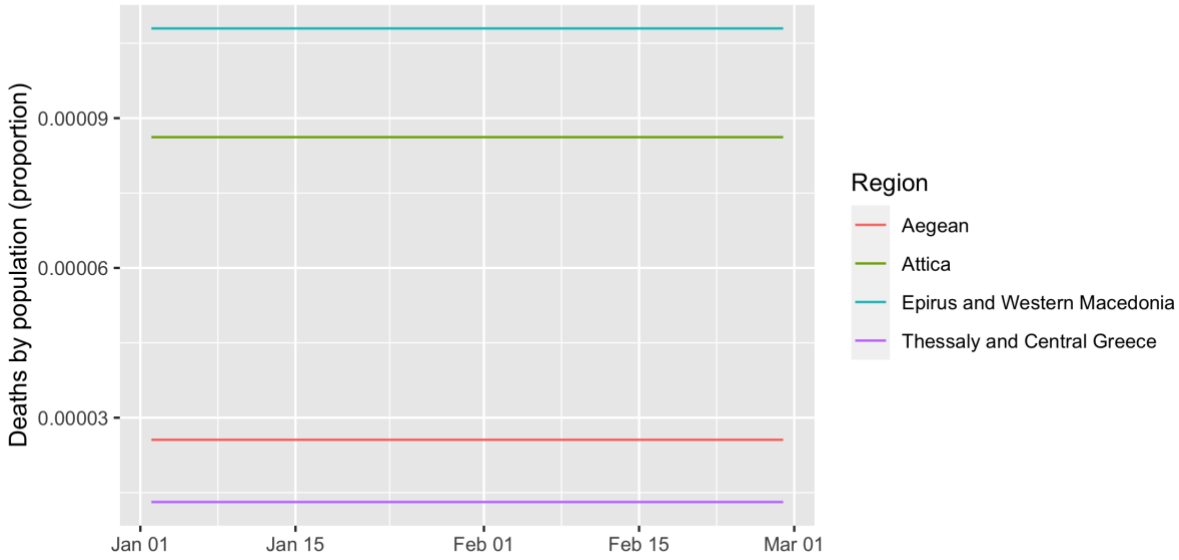
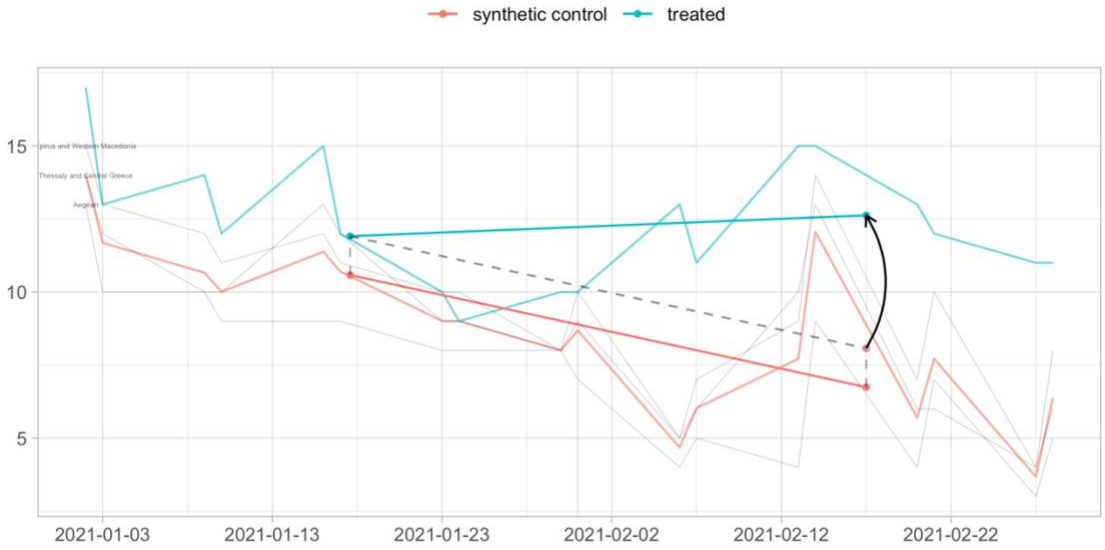


Figure A2 – Trends for Covid-19 death counts in the regions of Attica (treated) and (1) Aegean, (2) Epirus and Western Macedonia, and (3) Thessaly and Central Greece (controls).
Source: iMEdD (a non-profit journalism organization): https://lab.imedd.org/Direct data link: https://github.com/iMEdD-Lab/open-data/tree/master/COVID-19

A1. Synthetic Controls

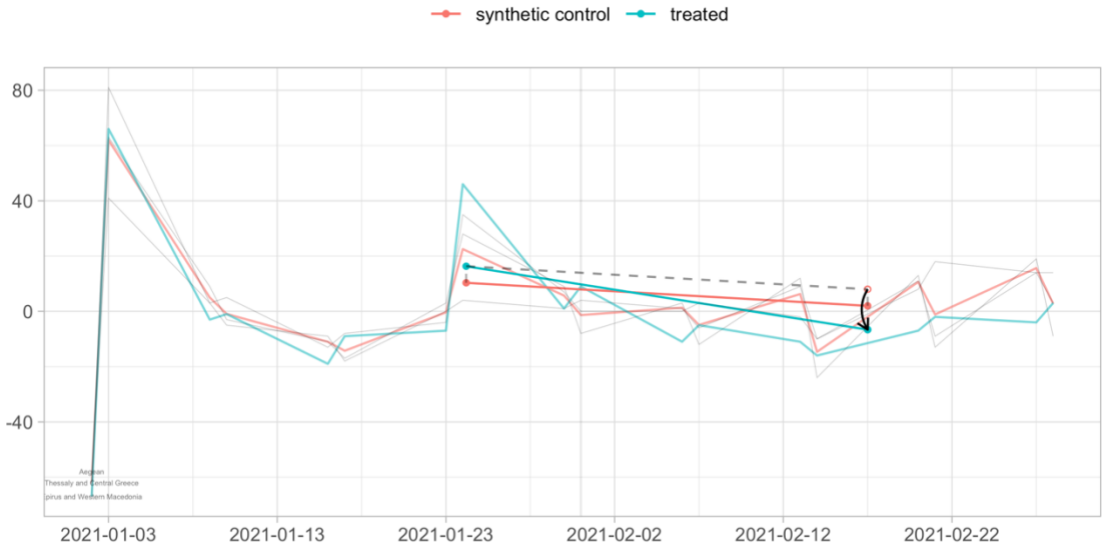
Applying the synthetic controls DiD, we find a significant positive effect [coeff: 4.55; 95%CI 3.91 to 5.20] on the relative time spent at home (Figure A3 in the Online Appendix), compared to the control group after the intervention. This means that people stayed at home 4.55% more once the time they were allowed to spend outside was reduced by 18.75% - strikingly similar to the baseline DiD estimate above. For the time spent in groceries or pharmacies on weekends (Figure A4 in the Online Appendix), the SDiD estimate showed a significant negative effect [coeff: -14.62; 95%CI -14.95 to 14.28] of the intervention on relative time spent. In practice, this suggests a 14.6% decrease in time people spent in groceries or pharmacies once the time allowed to be spent there was reduced by 3 hours (20-25% reduction in given that earliest opening time for groceries and pharmacies is 7am, and most open after 9am on the weekends). However it is worth noting that this empirical approach may practically ignore certain observations in order to match trends.



	Controls	Proportional Weight
Region	Thessaly and Central Greece	0.348
	Epirus and Western Macedonia	0.330
	Aegean	0.323
Time period	2021-01-17	0.955

Notes: Coeff 4.55; 95%CI [3.91, 5.20]. Trends in mobility over time for Attica (blue) and the relevant weighted average of control regions (red), with the weights used to average pre-treatment time periods in the table below. The dotted line shows the counterfactual estimate of the parallel trend. The estimated effect is indicated by an arrow.

Figure A3 – Synthetic DiD estimate for the relative mobility in residential locations over weekends - in the regions of Attica (treated) and (1) Aegean, (2) Epirus and Western Macedonia, and (3) Thessaly and Central Greece (controls).



	Controls	Proportional Weight
Region	Thessaly and Central Greece	0.340
	Epirus and Western Macedonia	0.333
	Aegean	0.327
Time period	2021-01-31	0.632
	2021-01-03	0.180
	2021-01-23	0.170

Notes: Coeff -14.62; 95%CI [-14.95, -14.28]. Trends in mobility over time for Attica (blue) and the relevant weighted average of control regions (red), with the weights used to average pre-treatment time periods in the table below. The dotted line shows the counterfactual estimate of the parallel trend. The estimated effect is indicated by an arrow.

Figure A4 – Synthetic DiD estimate for the relative mobility in groceries or pharmacies over weekends - in the regions of Attica (treated) and (1) Aegean, (2) Epirus and Western Macedonia, and (3) Thessaly and Central Greece (controls).

A2. Data Sources (as reported by iMEdD):

- The Hellenic National Public Health Organisation (EODY) and the Ministry of Health are the main sources of data that have been released through:
    - Announcements and transcripts of the press briefings published by EODY and the Ministry of Health.
    - Reports published in PDF files by EODY.
- Deaths data have been retrieved from fact-checked news reports, published in the Greek Press, since neither EODY nor the Ministry of Health announce official data about the geographical location of each death.

A2.1 Replicating the dataset: Mobility data

Google Mobility data are publicly available at https://support.google.com/covid19-mobility. We use the following variables: *residential_percent_change_from_baseline*, *grocery_and_pharmacy_percent_change_from_baseline*, *country_region*, and *date*. We select the period over 2 January-26 February 2021. This period comprises:

i. Five weekends of observations prior to the introduction of the 6pm weekend curfew in Attica. In this period the whole country under the daily 9pm-5am curfew unless specified otherwise (some local 6pm-5am curfews applied at the village/town level due to a rise in local cases).

ii. Four weekends after the introduction of the 6pm-5am curfew in Attica region but not in Aegean, Epirus & Western Macedonia or Thessaly regions (with local exceptions as explained in the main text).

A2.2 Data accuracy checks

Note that for days with low number of observations, Google records percentage change as unknown. This is due to not having "enough data to confidently and anonymously estimate the change from the baseline", Our dataset does not have such gaps in the data for any of the regions or dates, suggesting that each day had sufficient number of observations.

Google also recommends calibration of the data for regions. For example, major national holidays falling on different days of the week may affect the baseline. Greek Orthodox Christmas falls on 7th January, with 6th January thus being the Christmas Eve. For both 2020 (the baseline) and 2021 these two days fall on weekdays, thus not affecting the weekends data.

A2.3 Curfew data

Non-pharmaceutical measures related to Covid-19 are publicly available for most countries. For Greece, we used the following website: https://www.taxheaven.gr/widgets/covid19. The data were used to establish the date of the major change in curfew restrictions (6 Feb 2021) and to verify that the 6pm restrictions predominantly applied to the Attica region whilst Aegean, Epirus & Western Macedonia and Thessaly regions remained largely under the original 9pm curfew. For the robustness checks, we used the following regions as alternative controls: (i) Epirus & Western Macedonia, and (ii) Thessaly and Central Greece.