CS130 Final Code

April 21, 2023

0.1 Note

We were unable to install the `Synth` package locally. Hence, a copy of this notebook along with the output can be seem at the following link: https://sle-collaboration.minervaproject.com/?minervaNotebookId=clgq71w0300g70j2idt16bgec&userId=10865&name=Vikt
east-1.amazonaws.com/picasso.fixtures/Viktor_Tsvil_10865_2021-01-19T19%3A56%3A07.399Z&readOnly=0&isInstructor=0&signature=2e4dcfe11dd1ed06b9be8f2d910e4991b386b01c

0.2 Section 2: Replication

[1]:
```
# importing the dataset
countries <- read.csv('https://docs.google.com/spreadsheets/d/e/
 ↪2PACX-1vRLoQG5MffxU2wwyrZK4c8STty86OVFyf9VToHBP_3KR1B_BQPUYXtogye9h2IapxIqt0f4P4BZQcSW/
 ↪pub?gid=1300915934&single=true&output=csv')

# Convert to character to be compatible with dataprep
countries$Country <- as.character(countries$Country)
head(countries)
```

A data.frame: 6 × 13

	Id <int>	Country <chr>	Year <int>	GDP_2011 <dbl>	GFCF <dbl>	Inflation_prices <dbl>	Polity <dbl>	Export_ <dbl>
1	1	Armenia	1995	2173.36	16.15	175.95	3	NA
2	1	Armenia	1996	2336.52	17.88	18.68	-6	108285.
3	1	Armenia	1997	2441.18	16.20	13.96	-6	95669.0
4	1	Armenia	1998	2639.95	16.22	8.67	5	128305.
5	1	Armenia	1999	2744.43	16.42	0.65	5	56878.0
6	1	Armenia	2000	2924.75	18.44	-0.79	5	27496.5

[5]:
```
install.packages('synth')
require(Synth)

# obtain the score of trade dependency with Russia
countries$export_russia_share_GDP = countries$Import_Russia * 1000 /␣
 ↪countries$GDP_current_US
countries$import_russia_share_GDP = countries$Export_Russia * 1000 /␣
 ↪countries$GDP_current_US
countries$export_russia_share_export = countries$export_russia_share_GDP * 100 /
 ↪ countries$Total.Export
```

```
countries$import_russia_share_import = countries$import_russia_share_GDP * 100 /
 ↪ countries$Total.Import
countries$russia_trade_dependence = countries$export_russia_share_GDP +␣
 ↪countries$import_russia_share_GDP # aggregate trade amount

syn <- dataprep(
  foo = countries,
  predictors = c('russia_trade_dependence', 'HDI', 'Polity',␣
 ↪'Inflation_prices', 'GFCF'),
  special.predictors = list(
    list('GDP_2011', 2000, "mean"),
    list('GDP_2011', 2012, "mean")
  ),
  dependent = "GDP_2011",
  unit.variable = "Id",
  time.variable = "Year",
  controls.identifier = c(1:17),  # control units
  treatment.identifier = 18,  # treatment unit
  time.predictors.prior = c(1995:2012),  # pre-treatment
  time.optimize.ssr = c(1995:2012),
  time.plot = c(1995:2017),  # total timeframe
  unit.names.variable = 'Country')

# perform optimization
synth.out <- synth(syn)

# show the results
synth.tables <- synth.tab(
  dataprep.res = syn,
  synth.res = synth.out)
print(synth.tables)

# show the differences in GDP between Ukraine and synthetic unit
syn$Y1plot - (syn$Y0plot %*% synth.out$solution.w)
mean((syn$Y1plot - (syn$Y0plot %*% synth.out$solution.w))[2013:2017])

path.plot(dataprep.res = syn, synth.res = synth.out, Legend.
 ↪position=c("topleft"), Ylab = 'per capita GDP, 2011 international dollars␣
 ↪(PPP)')
abline(v=2012)
```

```
Installing package into ‘/home/viktor/R/x86_64-pc-linux-gnu-library/4.2’
(as ‘lib’ is unspecified)

Warning message:
"package ‘synth’ is not available for this version of R
```

```
A version of this package for your version of R might be available elsewhere,
see the ideas at
https://cran.r-project.org/doc/manuals/r-patched/R-admin.html#Installing-
packages"
Loading required package: Synth

Warning message in library(package, lib.loc = lib.loc, character.only = TRUE,
logical.return = TRUE, :
"there is no package called ‘Synth’"
```

```
Error in dataprep(foo = countries, predictors = c("russia_trade_dependence", :␣
 ↪could not find function "dataprep"
Traceback:
```

0.3 Part 3 Extension 1 (Extending Timeframe)

[ ]:
```
# extended data link
p3i1.link = "https://docs.google.com/spreadsheets/d/e/
 ↪2PACX-1vRLoQG5MffxU2wwyrZK4c8STty86OVFyf9VToHBP_3KR1B_BQPUYXtogye9h2IapxIqt0f4P4BZQcSW/
 ↪pub?gid=1793425122&single=true&output=csv"
countries <- read.csv(p3i1.link)

countries$Country <- as.character(countries$Country)
countries$export_russia_share_GDP = countries$Import_Russia * 1000 /␣
 ↪countries$GDP_current_US # in thouands of USD
countries$import_russia_share_GDP = countries$Export_Russia * 1000 /␣
 ↪countries$GDP_current_US # in thousands of USD
countries$export_russia_share_export = countries$export_russia_share_GDP * 100 /
 ↪ countries$Total.Export
countries$import_russia_share_import = countries$import_russia_share_GDP * 100 /
 ↪ countries$Total.Import
countries$russia_trade_dependence = countries$export_russia_share_GDP +␣
 ↪countries$import_russia_share_GDP # aggregate trade amount

syn <- dataprep(
  foo = countries,
  predictors = c('russia_trade_dependence', 'HDI', 'Polity',␣
 ↪'Inflation_prices', 'GFCF'),
  special.predictors = list(
    list('GDPpc2017', 2000, "mean"),
    list('GDPpc2017', 2012, "mean"),
    list('GDPpc2017', 2008, "mean")
  ),
  dependent = "GDPpc2017",
  unit.variable = "Id",
```

```
  time.variable = "Time",
  controls.identifier = c(1:17),
  treatment.identifier = 18,
  time.predictors.prior = c(1995:2012),
  time.optimize.ssr = c(1995:2012),
  time.plot = c(1995:2021),
  unit.names.variable = 'Country')

#Perform the optimization procedure
synth.out <- synth(
    syn,
    custom.v = c(0.2653768, 0.0001054143, 0.02362027, 0.031404951, 0.005282442,␣
 ↪0.07510658, 0.2386713, 0.3604323), #uncomment
)

#Show the results of SCM
synth.tables <- synth.tab(
  dataprep.res = syn,
  synth.res = synth.out)
print(synth.tables)

#Differences in GDP between Ukraine and synthetic unit
syn$Y1plot - (syn$Y0plot %*% synth.out$solution.w)

path.plot(dataprep.res = syn, synth.res = synth.out, Legend.
 ↪position=c("topleft"), Ylab = 'per capita GDP, 2017 international dollars␣
 ↪(PPP)', Xlab = 'Time\nOriginal Donor Pool')
abline(v=2012)
abline(v=2012, type='dashed')
```

0.4 Part 3 Extension Idea 1 + 2 (Extending Timeframe + Excluding Countries)

[ ]:
```
head(countries)

syn <- dataprep(
  foo = countries,
  predictors = c('russia_trade_dependence', 'HDI', 'Polity',␣
 ↪'Inflation_prices', 'GFCF'),
  special.predictors = list(
    list('GDPpc2017', 2000, "mean"),
    list('GDPpc2017', 2012, "mean")
  ),
  dependent = "GDPpc2017",
  unit.variable = "Id",
  time.variable = "Time",
```

```
  controls.identifier = c(3:7, 9:14, 17),      # <--------- look at this line
 ↪excludes 5 countries with the 6+ month long conflicts in time between 1995
 ↪and 2012 ('Armenia', 'Azerbaijan', 'Tajikistan', 'Kazakhstan', 'Kyrgyz
 ↪Republic')
  treatment.identifier = 18,
  time.predictors.prior = c(1995:2012),
  time.optimize.ssr = c(1995:2012),
  time.plot = c(1995:2021),
  unit.names.variable = 'Country')

#Perform the optimization procedure
synth.out <- synth(
    syn,
)

#Show the results of SCM
synth.tables <- synth.tab(
  dataprep.res = syn,
  synth.res = synth.out)
print(synth.tables)

#Differences in GDP between Ukraine and synthetic unit
syn$Y1plot - (syn$Y0plot %*% synth.out$solution.w)

path.plot(dataprep.res = syn, synth.res = synth.out, Legend.
 ↪position=c("topleft"), Ylab = 'per capita GDP, 2017 international dollars
 ↪(PPP)', Xlab = 'Time\nAdjusted Donor Pool')
abline(v=2012)
```