# Synthetic Control Methods

Worksheet (with answers)

For the full resource, see: <https://www.ncrm.ac.uk/resources/online/all/?id=20854>

**Scenario:**

A government introduced a new public health policy in **Country A** in 2020, aimed at reducing obesity rates. The policy included nationwide health awareness campaigns and taxation on sugary drinks.

You are tasked with **estimating the impact** of this policy on obesity rates using the Synthetic Control Method (SCM).

You have data from 2010 to 2024 for **Country A** (the treated unit) and three other countries (Country B, Country C, and Country D) that did not implement the policy (potential control units). The outcome is obesity rate. The independent variables are GDP per capita, mean age, urbanisation rate, and mean daily calorie intake per capita for each country for 2010-2024.

Open file **example\_data for exercise.csv**. It contains ID representing the numeric notation of country:

**Tasks:**

1. **Construct the Synthetic Control**:
   * Based on the pre-intervention data, create a weighted combination of **Country B, Country C, and Country D** to closely resemble **Country A** before 2020, after controlling GDP per capita, mean age, urbanisation rate, and mean daily calorie intake per capita for obesity rate. You can use [Synth](https://search.r-project.org/CRAN/refmans/Synth/html/dataprep.html) package for this task.
   * Suggest weights for each country (e.g., 50% of Country B, 30% of Country C, and 20% of Country D).
2. **Compare the Post-Intervention Trends**:
   * Predict what would have happened in **Country A** without the policy (use your synthetic control group).
   * Compare it with the actual post-intervention values of **Country A**.
3. **Interpret the Results**:
   * Did obesity rates decline in Country A compared to the synthetic control?
   * What does this suggest about the effectiveness of the policy?

***Answers   
(on the next page)…***

**Answers:**

1. **Constructing the Synthetic Control**

Please download the R script file - **synth\_example for exerercise.R -** for the calculation. A possible synthetic control could be:

* **Country B (81.3%)**
* **Country C (0.0%)**
* **Country D (18.7%)**

The **synthetic control** is estimated as:

(0.813×**B**) + (0.000×**C**) + (0.197×**D**)

Using this formula for the pre-intervention period, the synthetic control closely follows **Country A**’s trend for obesity rate.

1. **Comparison with Post-Intervention Trends**
   * What would have happened in **Country A** without the policy, predicted with the synthetic control group.

|  |  |
| --- | --- |
| Year | Synthetic control |
| 2020 | 66 |
| 2021 | 60 |
| 2022 | 64 |
| 2023 | 65 |
| 2024 | 60 |

* + Compare it with the actual post-intervention values of **Country A**.

|  |  |  |  |
| --- | --- | --- | --- |
| Year | Actual obesity | Synthetic control | Gap |
| 2020 | 62 | 66 | -4 |
| 2021 | 59 | 60 | -1 |
| 2022 | 59 | 64 | -6 |
| 2023 | 58 | 64 | -5 |
| 2024 | 57 | 60 | -3 |

1. **Interpretation**

* As **Country A’s** obesity rate declined overall than the synthetic control, it suggests that the policy was probably effective and contributed to the decrease in obesity.

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