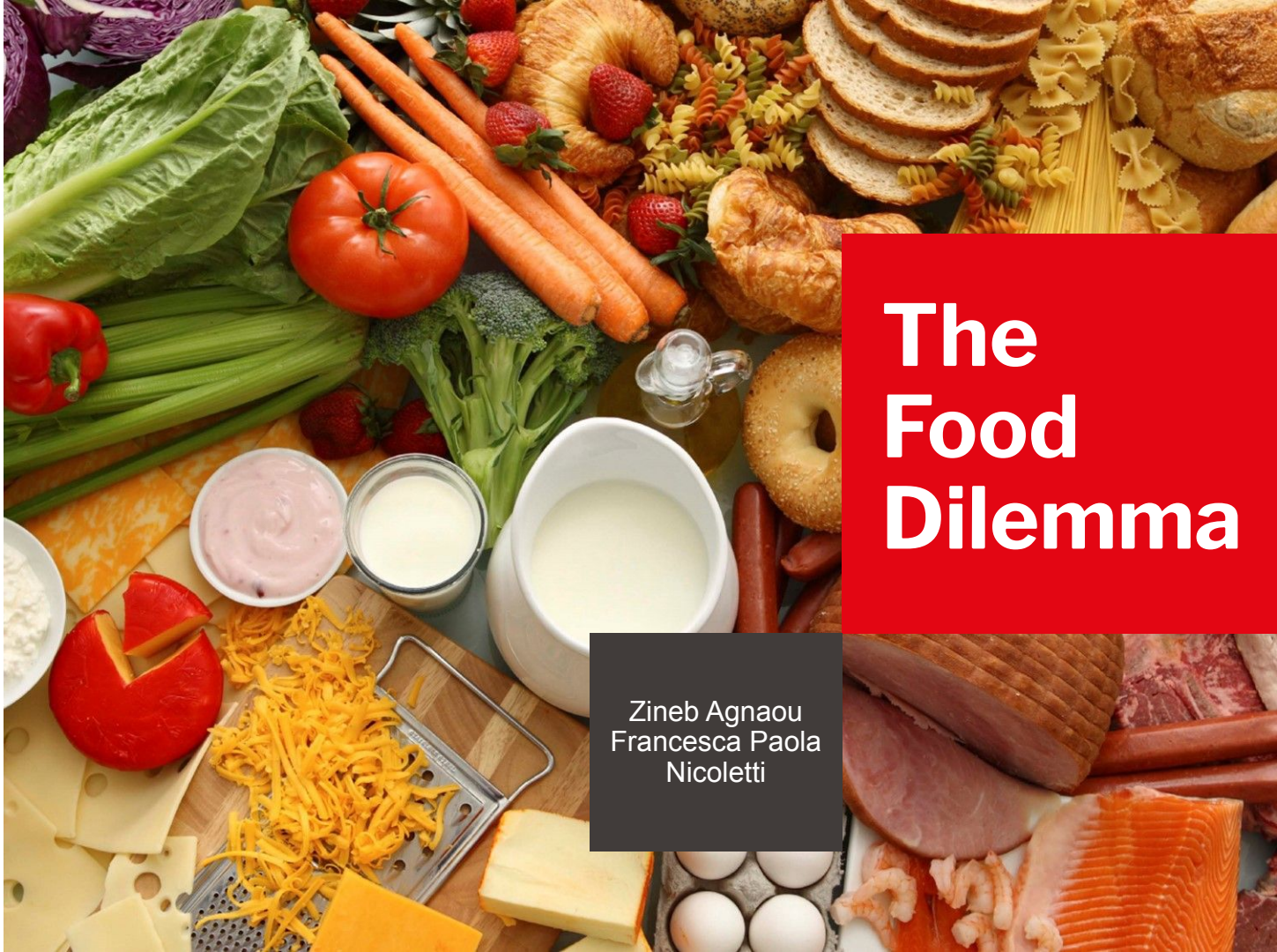


The Food Dilemma

Zineb Agnaou
Francesca Paola Nicoletti

Group 11
Performance Evaluation

Mini project

Problematic

- How does the carbon footprint emitted by our food vary according to our nutrition choices?
- How do global carbon emissions vary if an entire community begins to change its eating habits?

The Food Dilemma Menu

Appetizer : Salad with side

Main plate : Rice and vegetables with side

Dessert : Fruits milkshake

Drink : Alcohol

Time to make choices ...

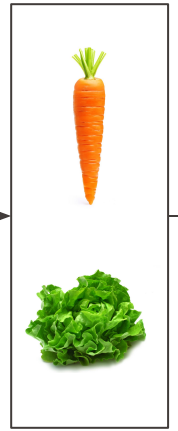
- **Menu type** : Omnivore, Vegetarian or Vegan 
- **Production type** : Conventional or Organic 
- **Origin of ingredients** : Local or From the largest producing country 
- **Transport mean of ingredients** : More or Less polluting 
- **Service Waste** : Take away or In restaurant 

Data Collection for carbon footprint

Queuing simulation

Ingredients' arrival

Production + Transport



Queue

Conservation

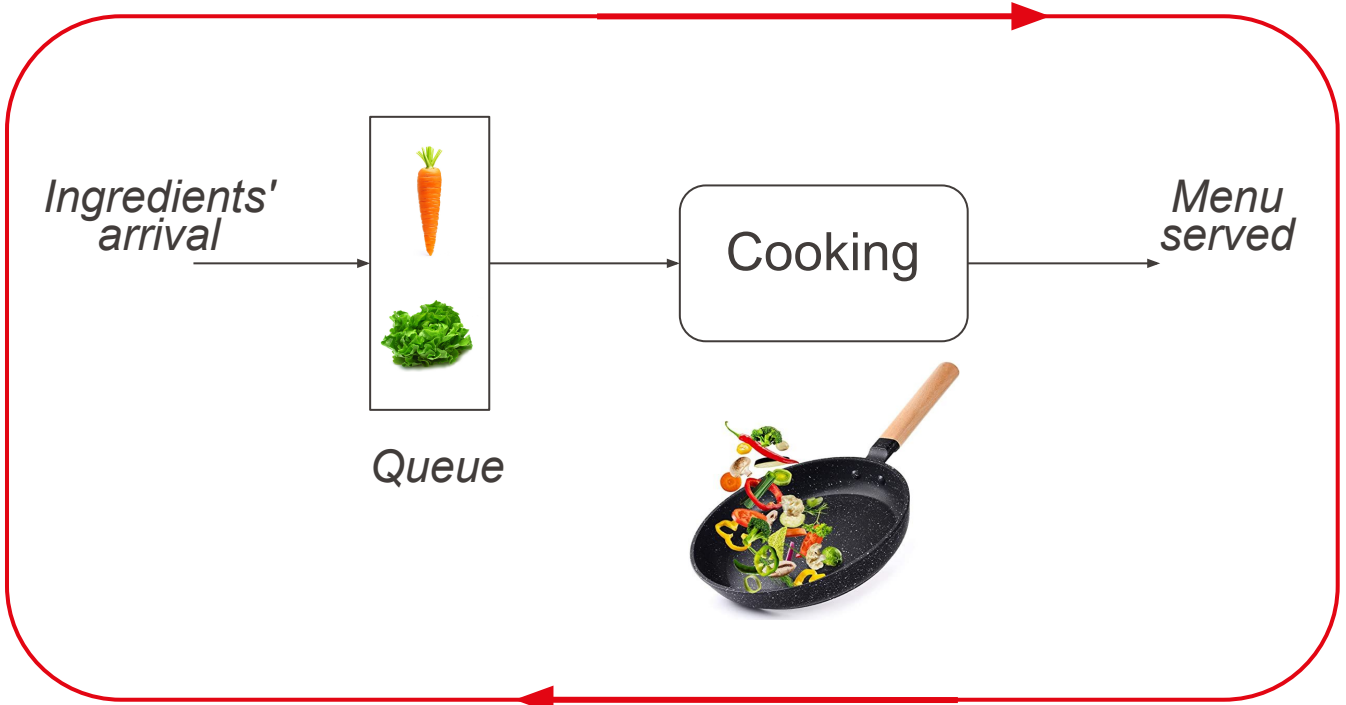
Cooking

Menu served

Service waste

Data Study

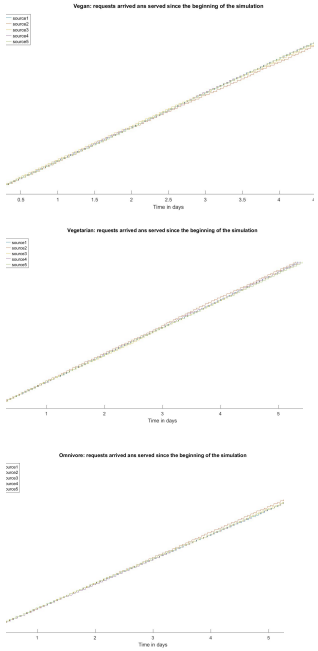
Zineb

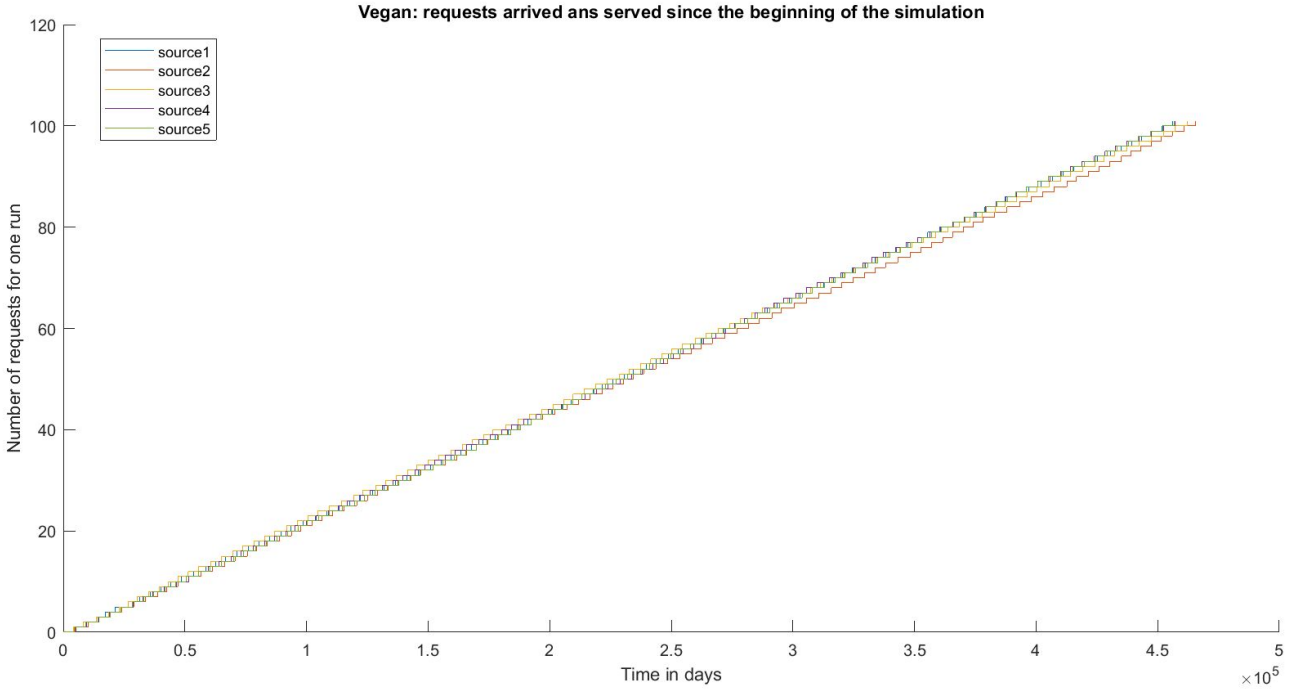


After the theory, we now work with our data !

Request across time

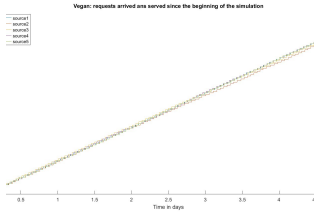
With one run:

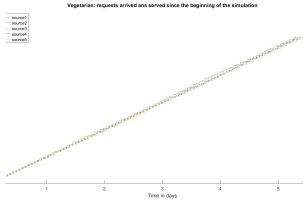


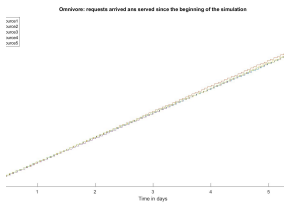


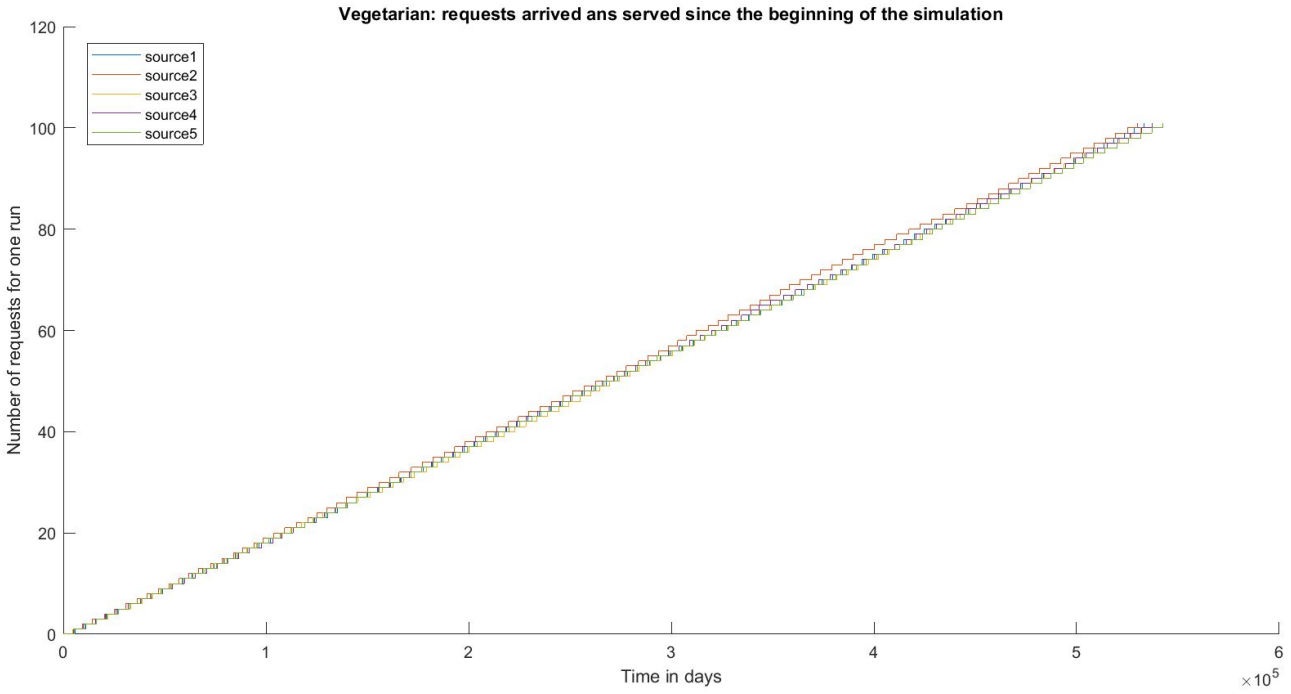
Request across time

With one run:



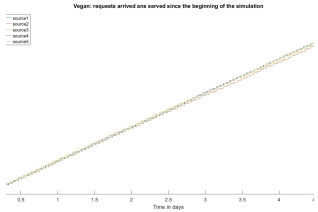


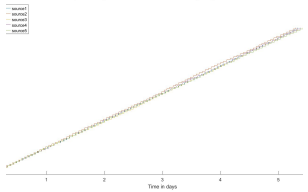


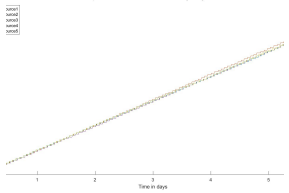


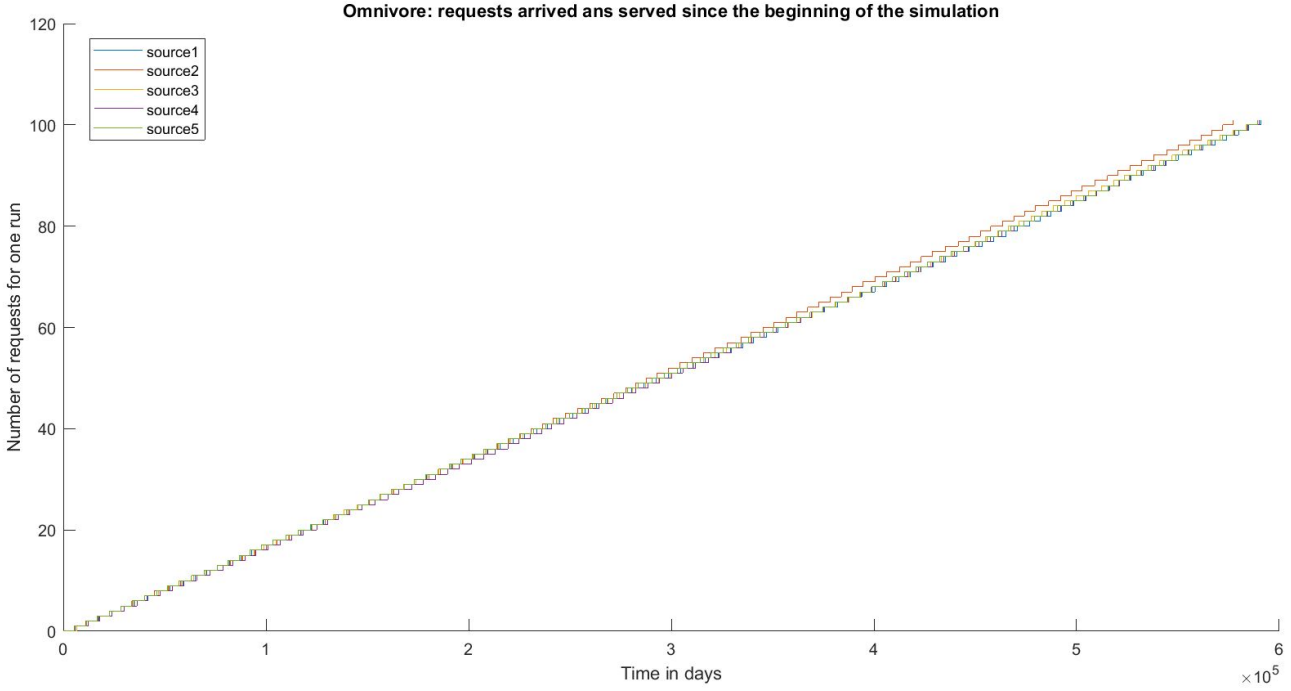
Request across time

With one run:

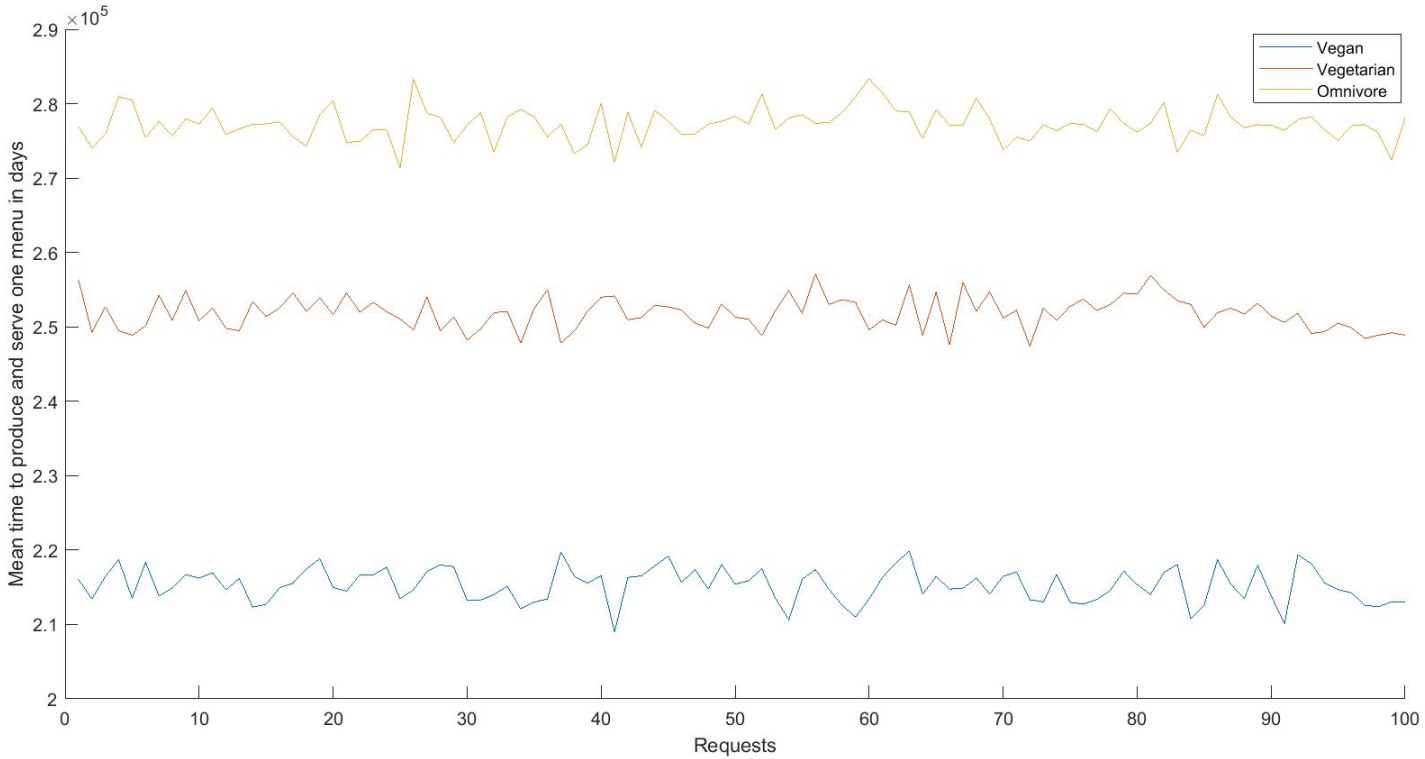








Mean time to Produce and Serve one menu



Mean Confidence Intervals

Zineb

THEOREM 2.2. *Let $X_1, ..., X_n$ be n iid random variables, the common distribution of which is assumed to have well defined mean μ and a variance σ^2. Let $\hat{\mu}_n$ and s_n^2 by*

$$\hat{\mu}_n = \frac{1}{n}\sum_{i=1}^{n} X_i \tag{2.19}$$

$$s_n^2 = \frac{1}{n}\sum_{i=1}^{n} (X_i - \hat{\mu}_n)^2 \tag{2.20}$$

The distribution of $\sqrt{n}\frac{\hat{\mu}_n - \mu}{s_n}$ converges to the normal distribution $N_{0,1}$ when $n \to +\infty$. An approximate confidence interval for the mean at level γ is

$$\hat{\mu}_n \pm \eta \frac{s_n}{\sqrt{n}} \tag{2.21}$$

where η is the $\frac{1+\gamma}{2}$ quantile of the normal distribution $N_{0,1}$, i.e $N_{0,1}(\eta) = \frac{1+\gamma}{2}$. For example, $\eta = 1.96$ for $\gamma = 0.95$ and $\eta = 2.58$ for $\gamma = 0.99$.

Median Confidence Intervals

THEOREM 2.1 (Confidence Interval for Median and Other Quantiles). *Let $X_1, ..., X_n$ be n iid random variables, with a common CDF $F()$. Assume that $F()$ has a density, and for $0 < p < 1$ let m_p be a p-quantile of $F()$, i.e. $F(m_p) = p$.*
Let $X_{(1)} \leq X_{(2)} \leq ... \leq X_{(n)}$ be the order statistic, i.e. the set of values of X_i sorted in increasing order. Let $B_{n,p}$ be the CDF of the binomial distribution with n repetitions and probability of success p. A confidence interval for m_p at level γ is

$$[X_{(j)}, X_{(k)}]$$

where j and k satisfy

$$B_{n,p}(k-1) - B_{n,p}(j-1) \geq \gamma$$

See the tables in Appendix A on Page 311 for practical values. For large n, we can use the approximation

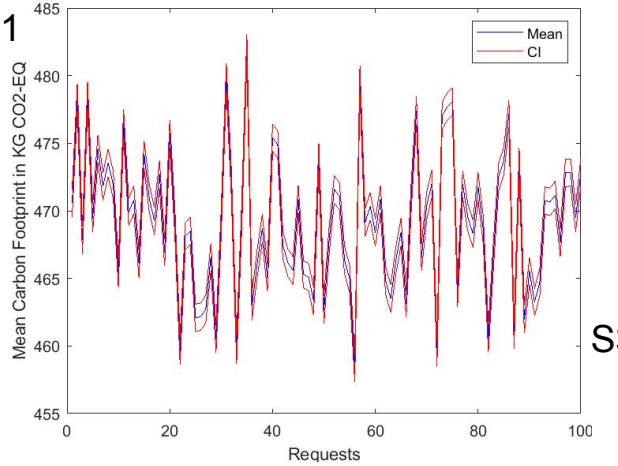
$$\begin{aligned} j &\approx \lfloor np - \eta\sqrt{np(1-p)} \rfloor \\ k &\approx \lceil np + \eta\sqrt{np(1-p)} \rceil + 1 \end{aligned}$$

where η is defined by $N_{0,1}(\eta) = \frac{1+\gamma}{2}$ (e.g. $\eta = 1.96$ for $\gamma = 0.95$).

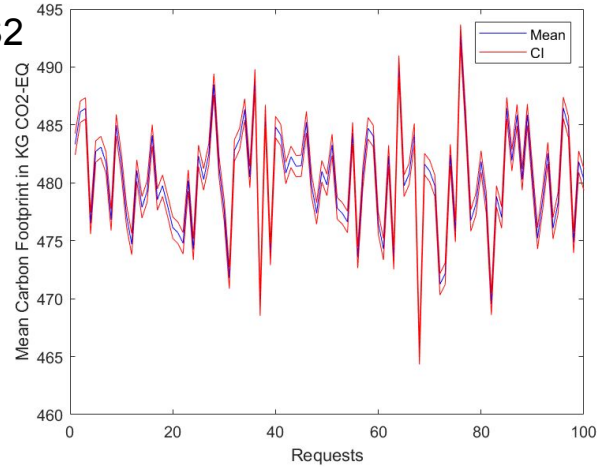
Mean carbon footprint CI

Vegan, local, in restaurant

S1



S2



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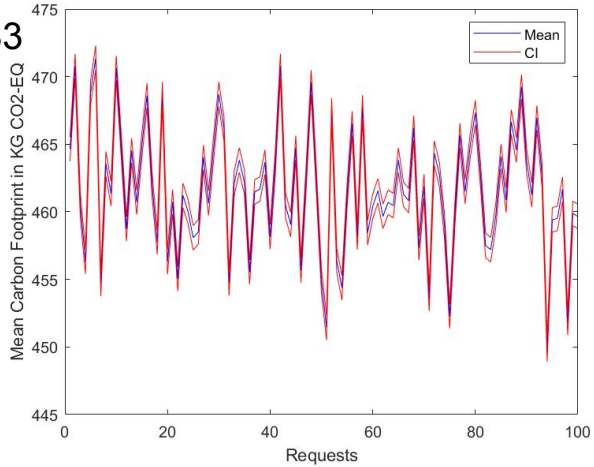
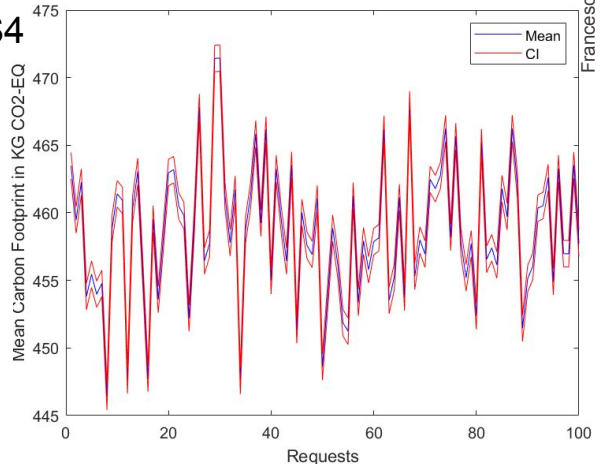
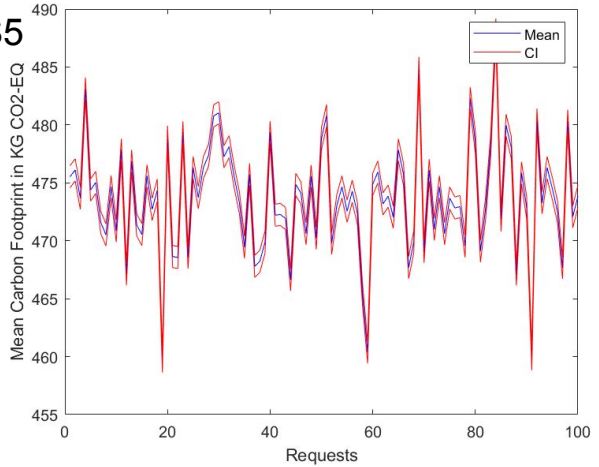


S4



S5

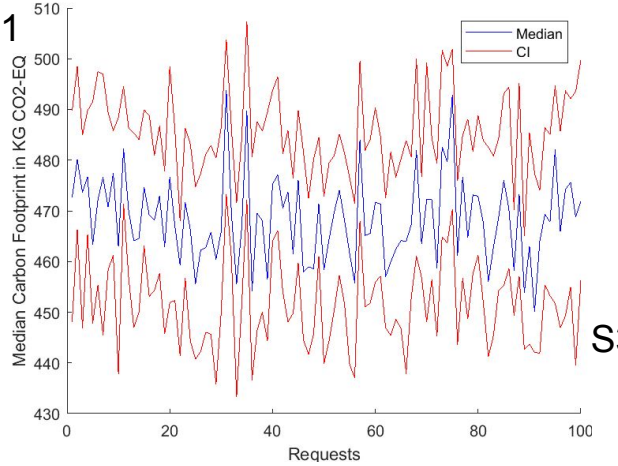


Francesca

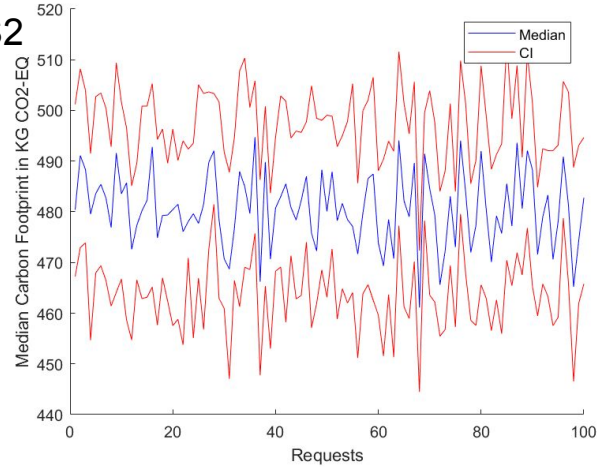
Median carbon footprint CI

Vegan, local, in restaurant

S1



S2



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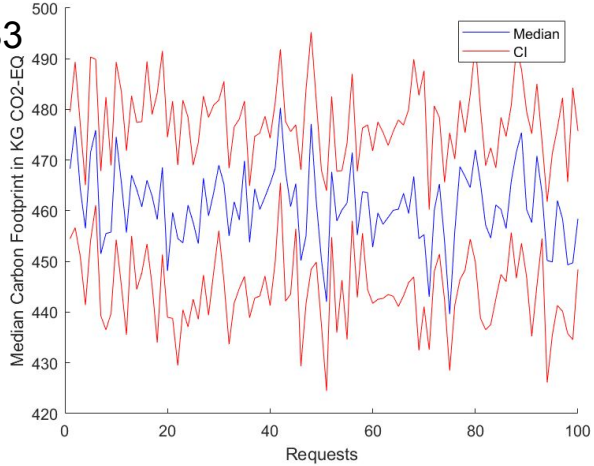

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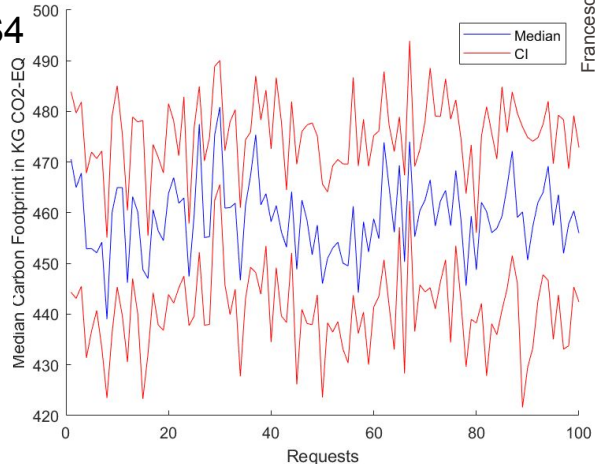
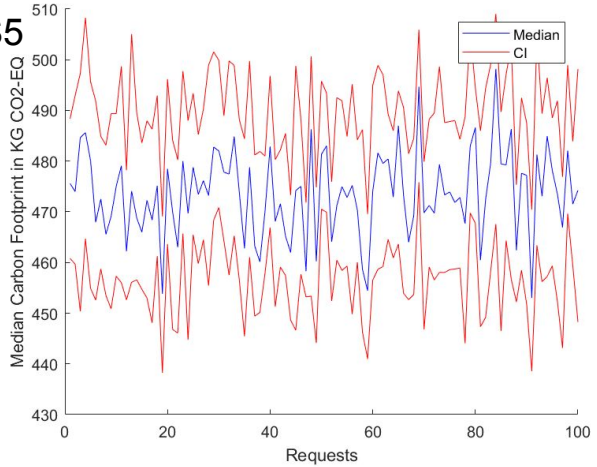
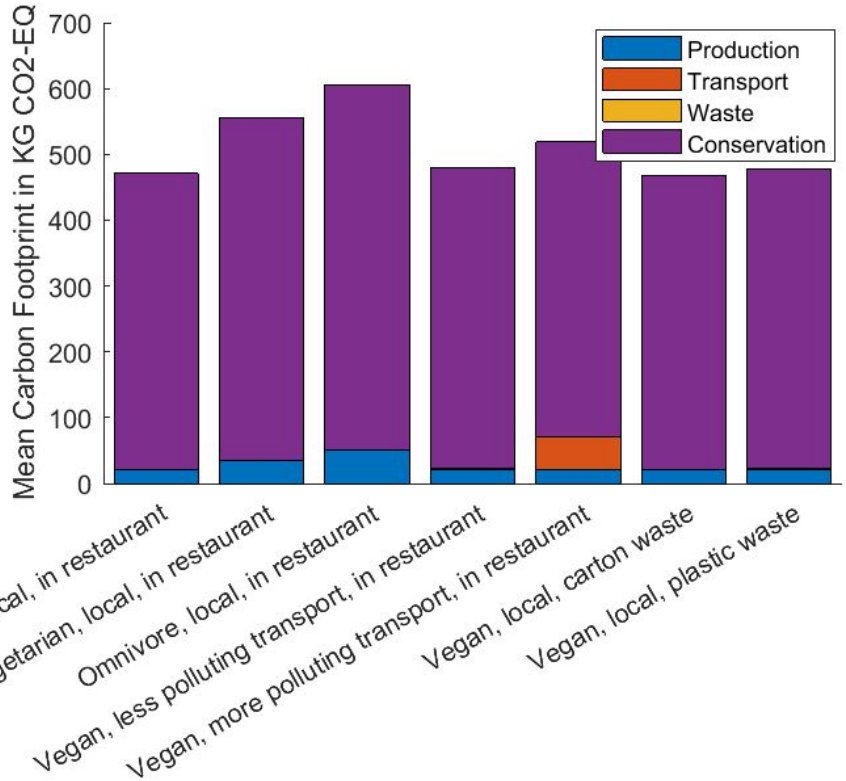


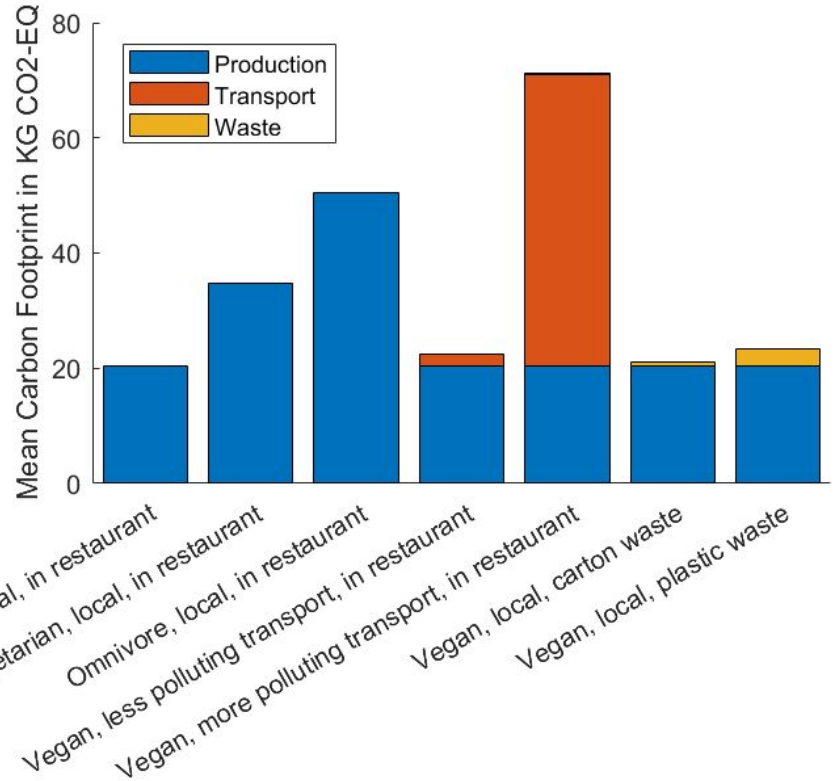
S5



Climate Change Results Overview



Climate Change Results Overview



Simulation of effect of students' meal choices over one semester

Can the epfl community and more specifically the students make an impact by changing their eating habits in order to improve the carbon footprint of the campus ?

Simulation of effect of students' meal choices over one semester

Week 1:

Vegan:3%
Vegetarian: 11%
Omnivore: 86%

Undefined production:45%
Conventional production:50%
Organic production: 5%

Local/no transport:56%
Less polluting transport: 36%
More polluting transport: 8%

Eating in the cafeteria:50%
Carton and reusable takeaway: 4%
Takeaway with plastic: 46%

Week 14:

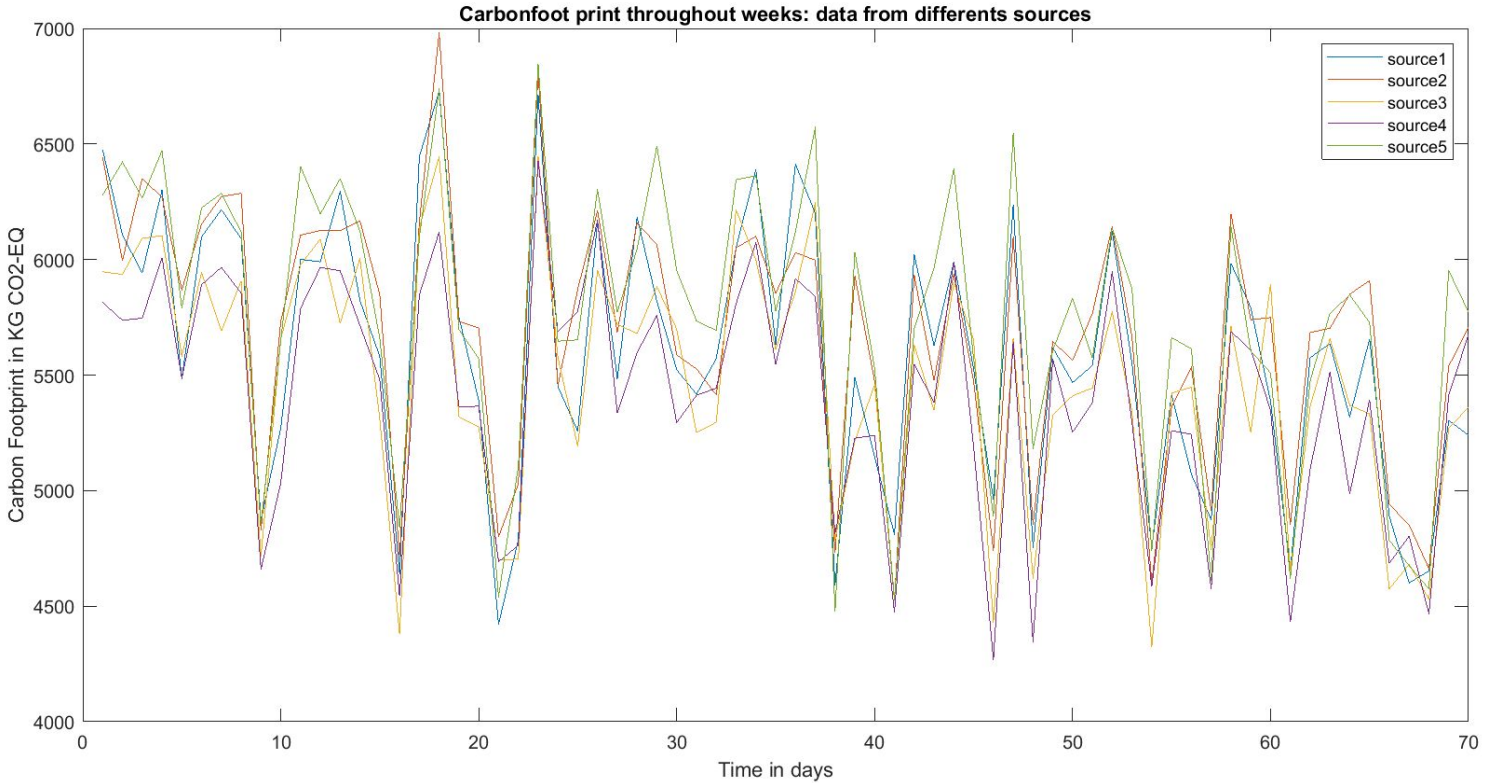
Vegan:68%
Vegetarian: 26%
Omnivore: 6%

Undefined production:5%
Conventional production:10%
Organic production: 85%

Local/no transport:95%
Less polluting transport: 5%
More polluting transport: 0%

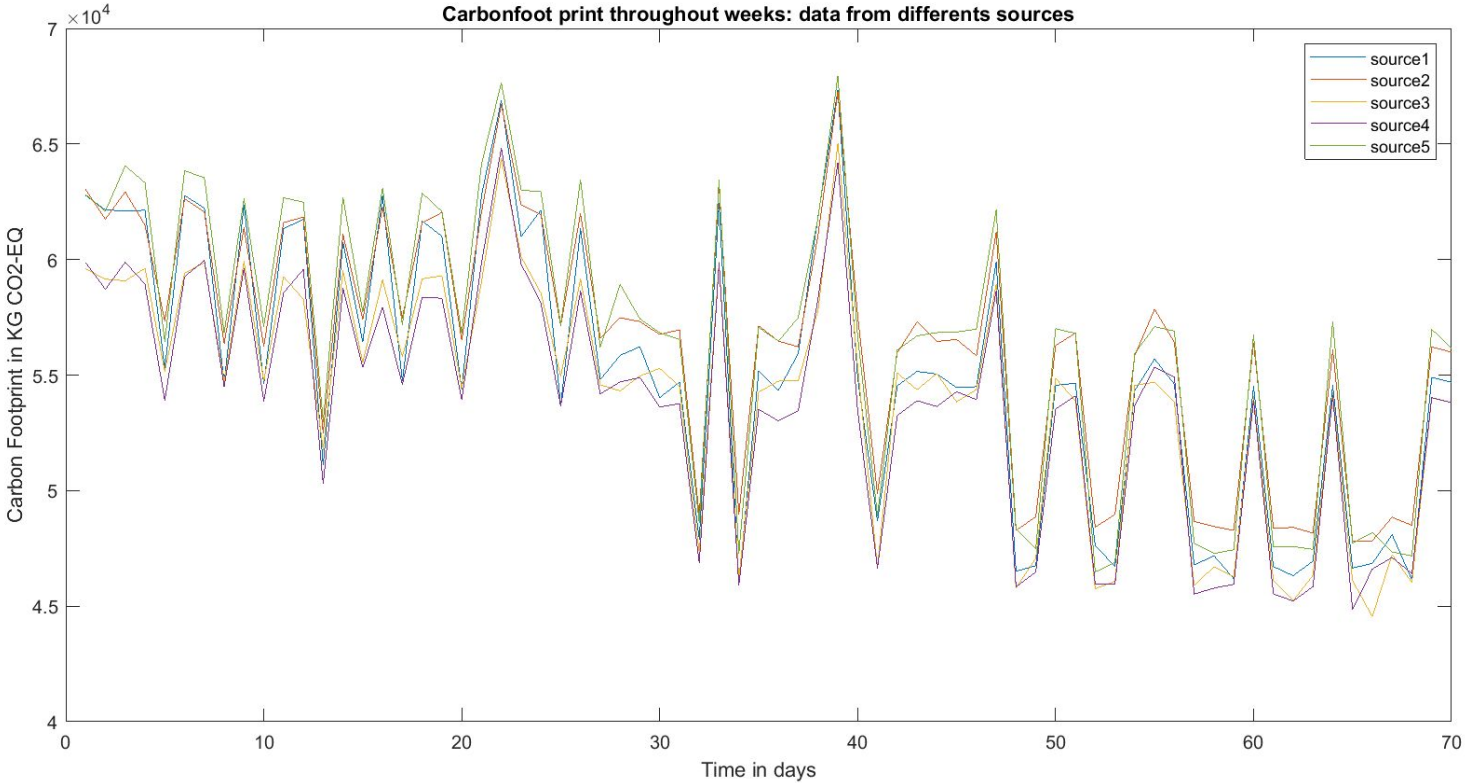
Eating in the cafeteria:50%
Carton and reusable takeaway: 50%
Takeaway with plastic: 0%

Simulation of effect of students' meal choices over one semester: 10 students.



Zineb

Simulation of effect of students' meal choices over one semester: 100 students.

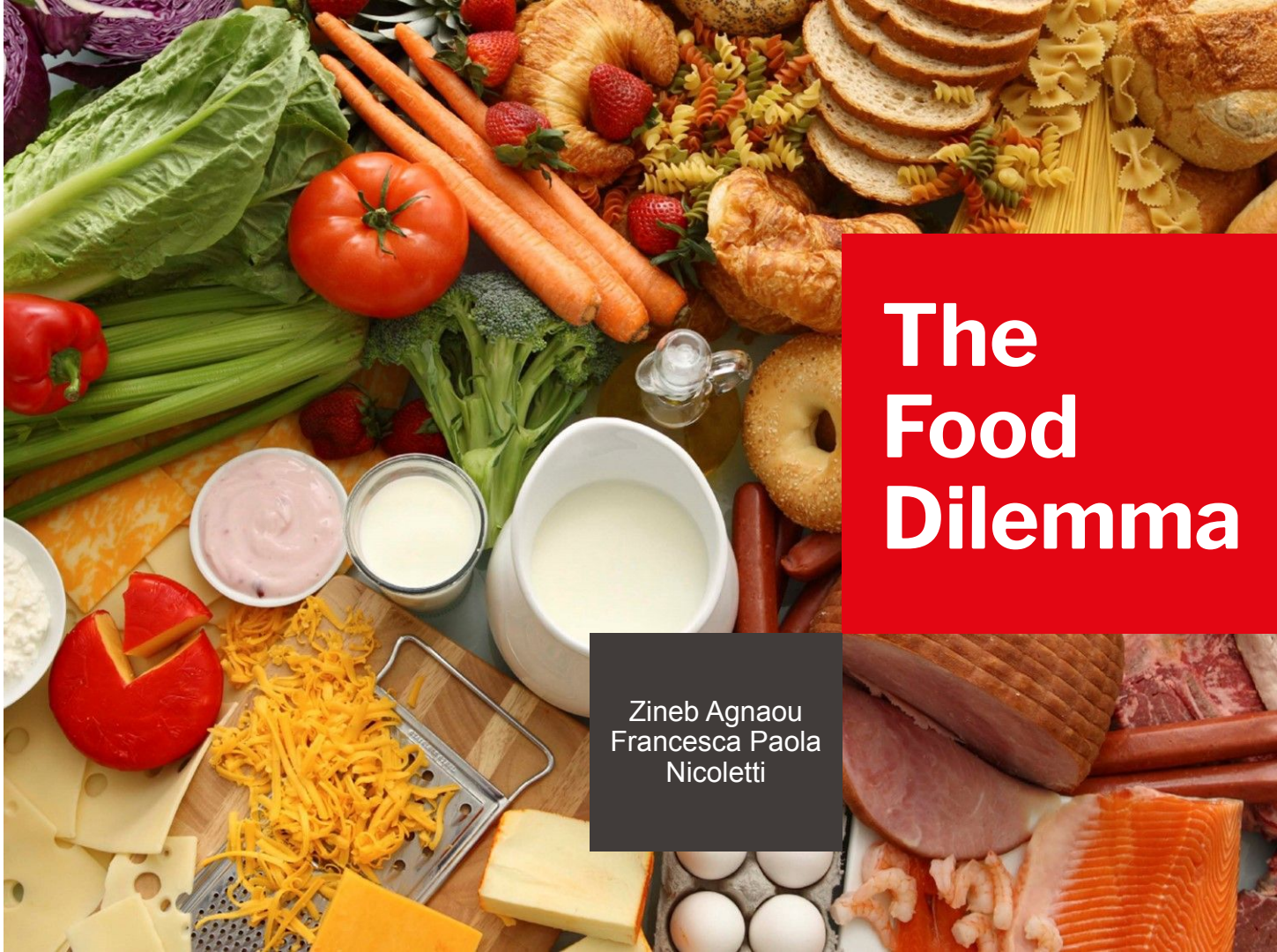


Simulation : results

- All the students combined : drop of the carbon footprint of the campus by **1000 tons**.
- 10 students make a **significant** difference.
- **10'000 imperfect actions are better than 1 perfect action.**

Thank you for your attention !

Any questions ?



The Food Dilemma

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