

Ceci n'est pas de l'archéologie?

A Bayesian approach to understand consumption dynamics in Ancient Rome

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EPNet Project

Production and distribution of food during the Roman Empire:
Economic and political dynamics

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Outline

- Introduction
- Quantitative Analysis: Bayesian Method
- Archaeological data
- Methods and Results
- Discussion
- Conclusion

Historical context

- Roman Empire is considered as one of main economic networks of the Mediterranean trade
- The archaeological records allow to show the complex dynamics of consumption
- Consumption dynamics can be detected for the distribution of the pottery



Research Questions

- Was the Roman economy a free market?
- What was under the control of the Roman Empire?

Main challenges

What are we going to find?

- "Inaccurate" historical sources to develop a hypothesis
- Poor quality of archaeological data
- High levels of uncertainty associated to the archaeological dataset

Case Study

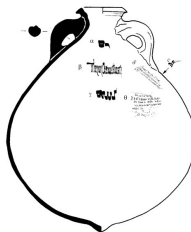
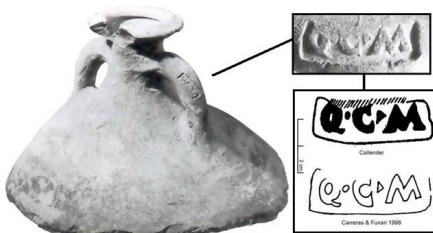
- Monte Testaccio (Rome, Italy)
- Artificial mount composed of fragments of broken amphorae
- Amphorae from Baetica (mostly), Africa and Gaul
- 1st-3rd centuries AD



Case Study: Archaeological data

Dressel 20

- Amphorae stamps
- *Tituli picti*

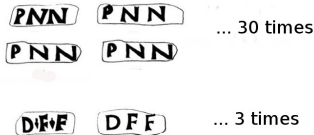


Approach

- Analyse the economic activities from data of *Monte Testaccio*
- Ideal data:
 - Analysis of frequency of distribution of different producers (type Dressel 20)
- Proxy data
 - Stamps are used as proxy-data to measure this frequency

A Method to analyse

- Define a statistical model to each hypothesis
- Explore the codes found in the stamps (different producers)
- We measure the frequency distribution of each one



PNN is identified as olive oil producers more **bigger** than **DFF**

Hypotheses

- 1. The demand of olive oil was covered by small-size agents (producers)
- 2. Presence of major producers (State control)
- 3. Small-size producers survive to the increase and concentration of lands in hands of few producers
- 4. Pareto principle: 80/20.

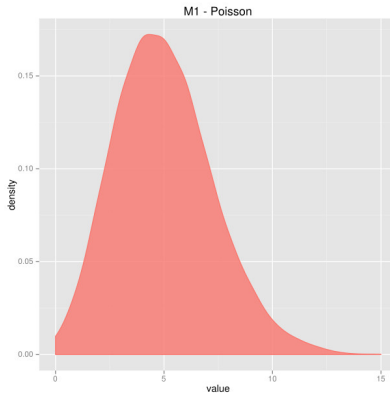
Quantitative analysis of archaeological data

Why **Bayesian Method** in Archaeology...?

- Quantitative methods provide a scientist basis to the archaeological data
- Possibility of testing what model explains better the evidence
- Integrates the level of uncertainty in archaeology

M1: Poisson distribution

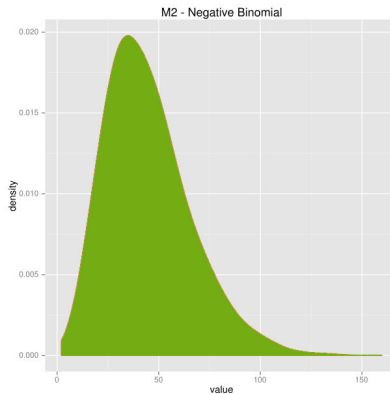
- The demand of olive oil was covered by small agents (producers)
- Frequency of producers



Parameter: Lambda (U(1,30))

M2: Negative binomial

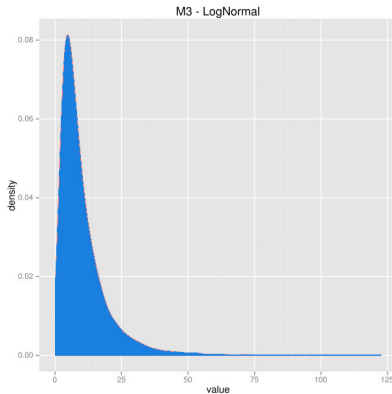
- Add variance: presence of major producers (State Control)



Parameters: size (U(1,100)) prob (U(0,1))

M3: Lognormal distribution

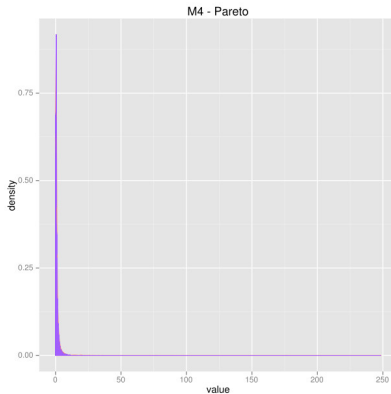
- Small producers survive to the increase and concentration of lands in hands of few producers
- Concentration of land in few hands



Parameters: μ (U(0.1,4)) σ (U(0.1,3))

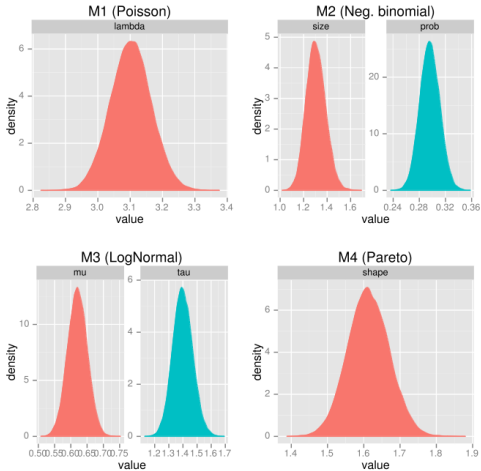
M4: Pareto distribution

- 80% of the market was dominated by 20% of the producers
- Common structure in current markets



Parameters: shape (U(0.1,10) xm (1)

MCMc simulation



Deviance Information Criteria (DIC)

- Smaller values
- M4 fits better to the evidence

Model	DIC
M1	5363.9
M2	3595.6
M3	2969.9
M4	1813.7

Results

- Our hypothesis fits to the models proposed
- Last model is better to fit to the evidence
- Large producers coexisted with the high presence of different small-size producers (different stamps)

Discussion

- Results suggest the existence of a free market of olive oil production in the Roman Empire
- These results match the frequency distribution of current company sizes
- Useful tool in contexts with high level of uncertainty such as Archaeology

Thank you for your attention!

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