USS-SWC – 2015 Presentation: ABM & History

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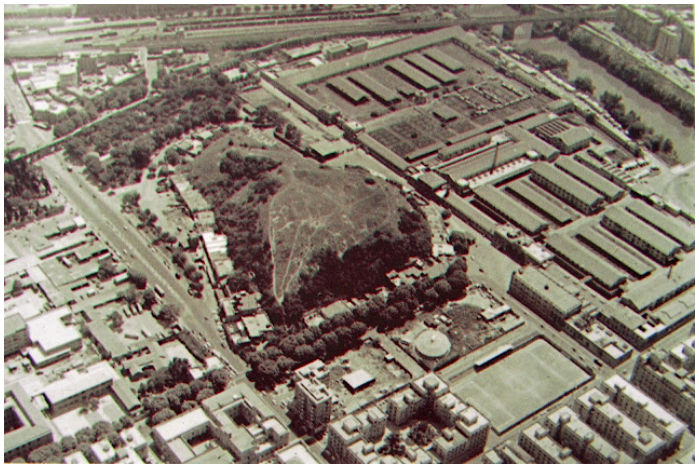
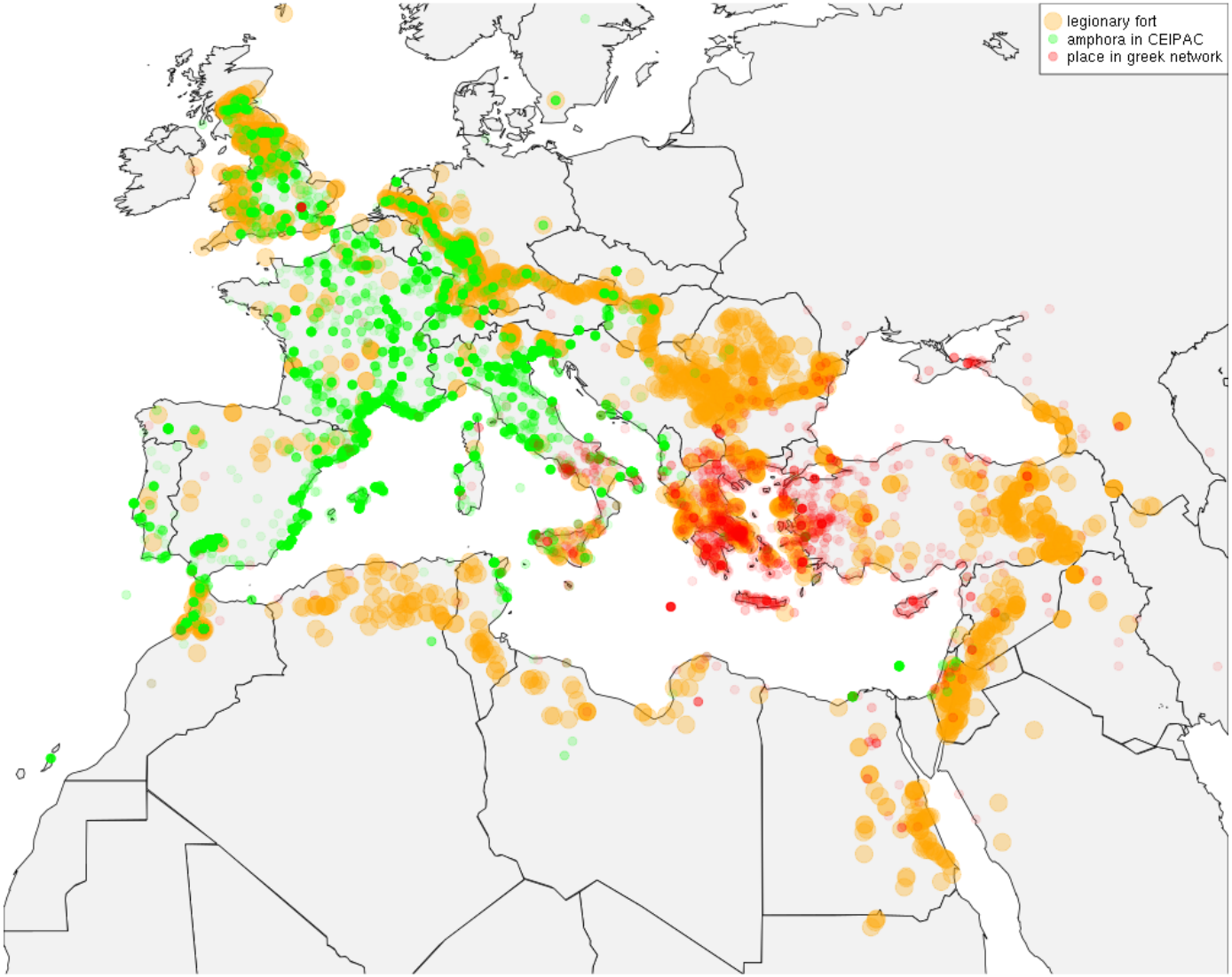
The Monte Testaccio

An amphora garbage in Roma.



Data

About 47000 amphora from CEIPAC database and other data in other databases (places in Pleiade, Greek names in Oxford...)



What was the nature of the Roman Economy?

The primitivism/modern debate

The Roman Economy was already a free-market similar as today vs all price were fixed by the state, no free market, us of slave.

Computer Side, a Starting Point

An Agent Based Model mixing to main aspects (WSC – 2015):

1. a simple bargain mechanism,
2. and (cultural) evolutionary dynamics.

$\rightarrow$ Implement a "simple" theoretical abstract model, *to be "complexified"*.

Bargain Mechanisms

Bargaining

- Agents have :
  - Goods
  - Value they attribute to goods
- Agents produce 1 good and use it to exchange for the other goods, given the value they associate to each good.
- After the exchange, agents consume the goods and get a "score" (utility?) depending on the amount of good they gather and a scale of "universal intrinsic value" for each good.

Evolutionary Dynamics

Evolving

After 10 steps of exchange :

- The less successful (in term of utility) agents copy the set of value of the most successful agent (Biased-Copy/selection).
- Given a probability μ the value attributed to some goods are modified (Innovation/Mutation)

Parameter Exploration & Epistemic Opacity

Illustrate the opacity :

- One simulation : 57min
- 100 simulations (statistical need) : 5700min $\approx$ 4 days

Lets try with :

- 10 different probability exchange right. (0.001 to 0.20)
- 3 size of population (250 , 500 , 1000)
- And different number of goods : (3, 6 , 9)

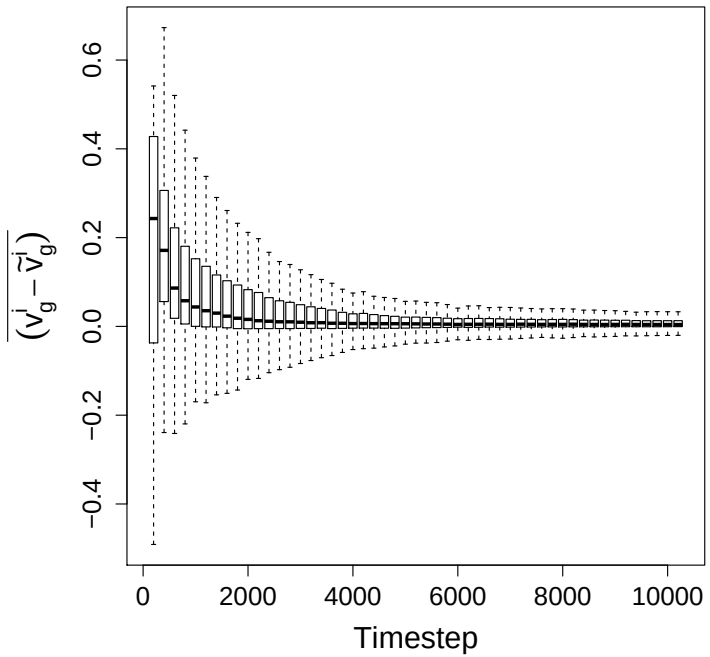
$= 10 \times 3 \times 3 = 90$ "environments" (experimental setups).

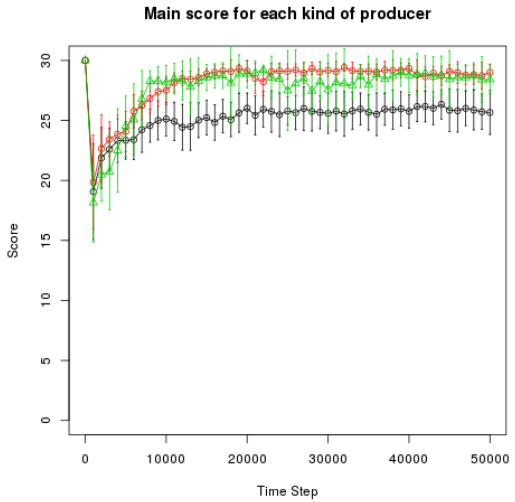
$\rightarrow$ 360 days of continuous simulations.

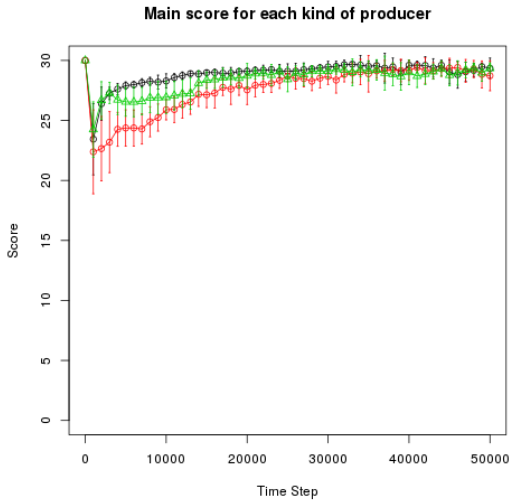
Price Equilibrium

Result for 3 goods and 500 agents

Without surprise, the system evolves toward an equilibrium where all agents adopt optimal prices (clearing-market prices).







Underlying code

```
//Compute the score for each good
while(it!=allGood.end())
{
        std::string good=std::get<0>(*it);
        //in the case it is its production good
        if(good == std::get<0>(romanAgent.getProducedGood()))
                romanAgent.setQuantity(good,romanAgent.getPrice(good));

        //fit= |a-b|/euclideDist(a,b) my favorite one
        if(romanAgent.getQuantity(good)==(romanAgent.getNeed(good)))uti
        else utilityFunction+=std::abs((romanAgent.getQuantity(good))-(
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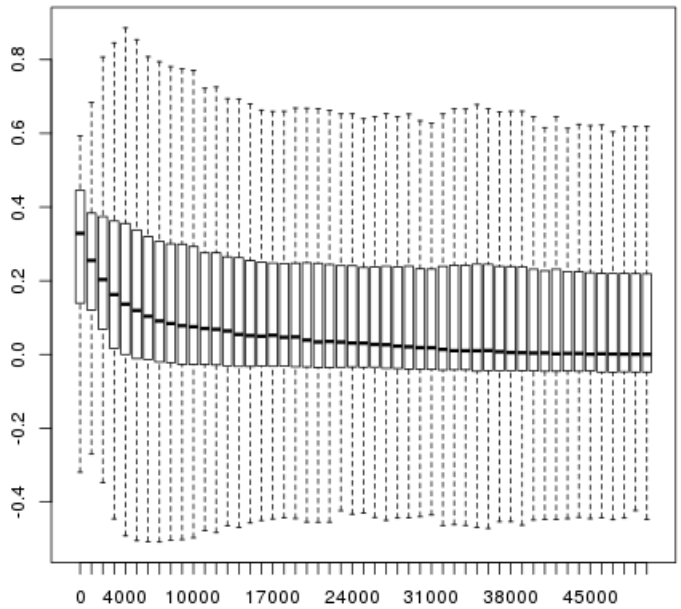

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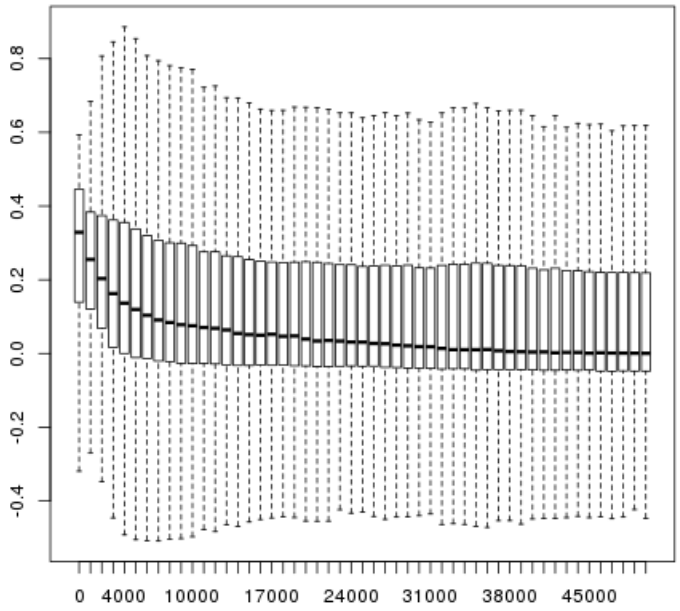
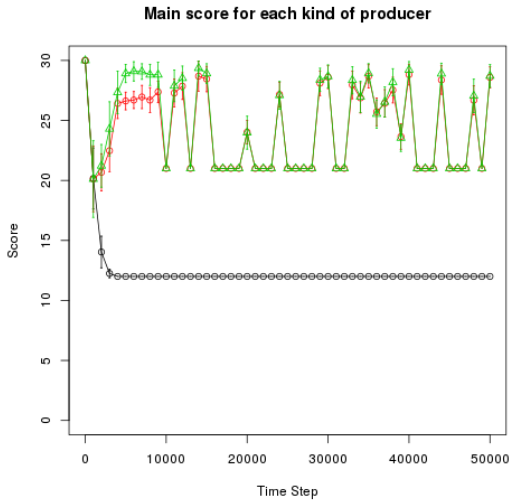
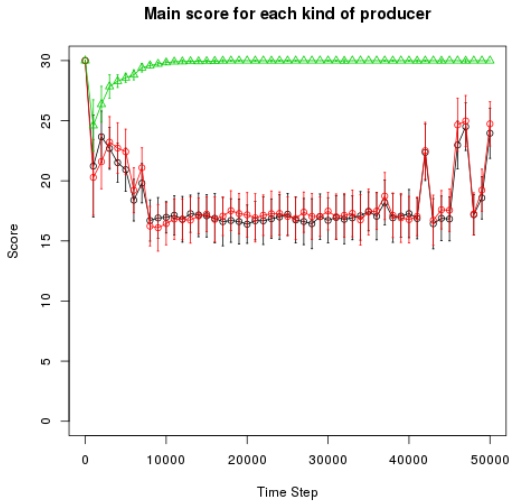






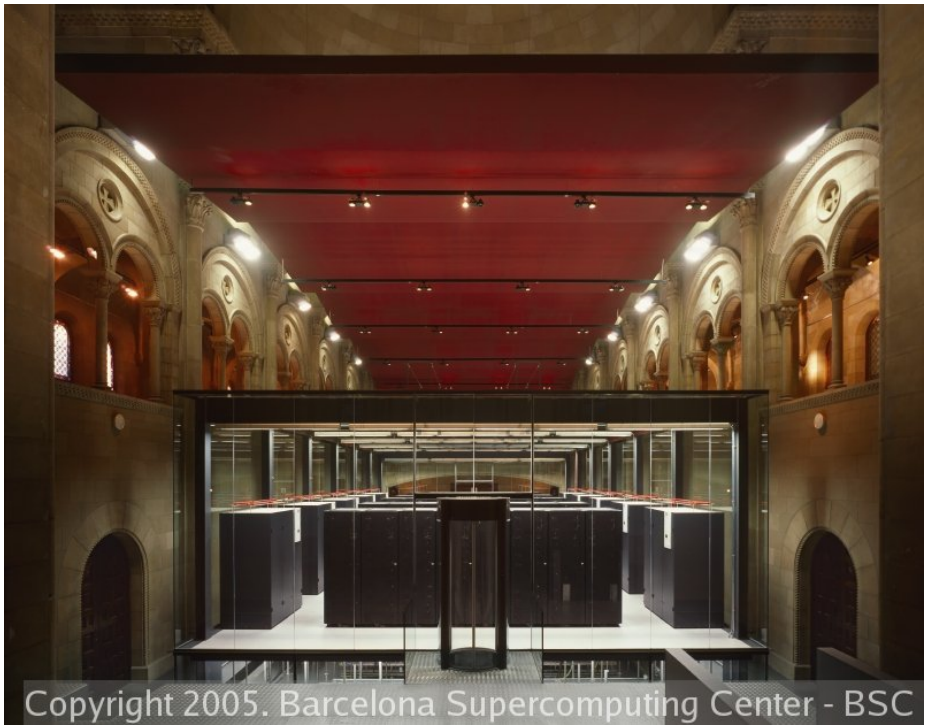
What does all that mean?
Epistemological uncertainty...

What was the nature of the Roman Economy?

De-idealization needed, yes, but how?

- A "guided" de-idealization?

Thanks for you attention.



The fitness/utility/consumption function

$$s_j^i = \begin{cases} s_{max} = 1 & \text{if } q_j^i = n_j \\ 1 - \dfrac{\left| q_j^i - n_j \right|}{\sqrt{\left| (q_j^i)^2 - (n_j)^2 \right|}} & \text{if } q_j^i \neq n_j \end{cases} \quad (1)$$

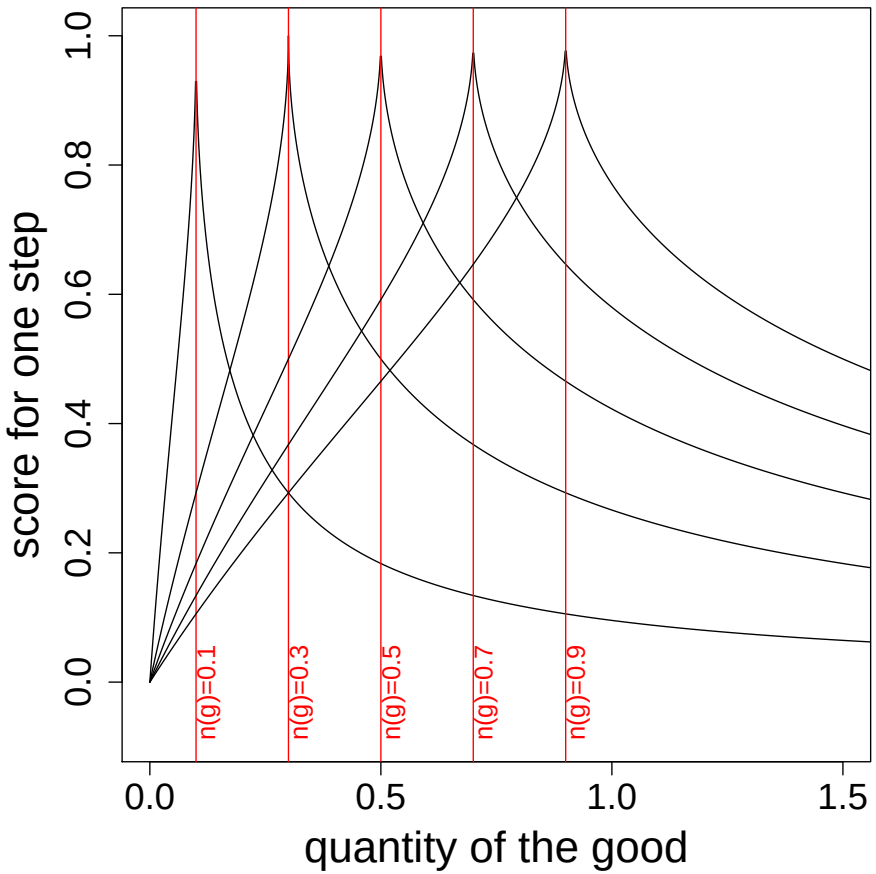


Figure: The utility for different value in the "universal scale"