Agent based simulation of incentive mechanisms for photovoltaic adoption

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Context

- Sustainable energy policies
  - Complex issues: rapidly changing environments, conflicts among different interests..
  - Strong impact on economic development sustainability and social acceptance
- **ePolicy** European project
  - Aim: provide decision support systems for policy makers
  - Case study: Emilia-Romagna regional Energy Plan

The Problem

- Policy makers can use several instruments to foster the transition towards renewable energies
  - Feed-in tariffs, tax exemptions, fiscal incentives, grants, etc.
- Focus: photovoltaic (PV) energy
- We must evaluate the impact of such incentives
  - Each instrument has a cost
  - The PV plants (panels) are installed by citizens and enterprises → no direct government bodies actions
  - We need to understand the *social reaction* to policy instruments

Proposed Approach (1)

- We are dealing with a complex problem
- To aid policy makers to evaluate the best implementation policy we propose an agent-based model

- Two main goals:
  1. Model the diffusion of residential PV systems
  2. Assess the impact of the incentives

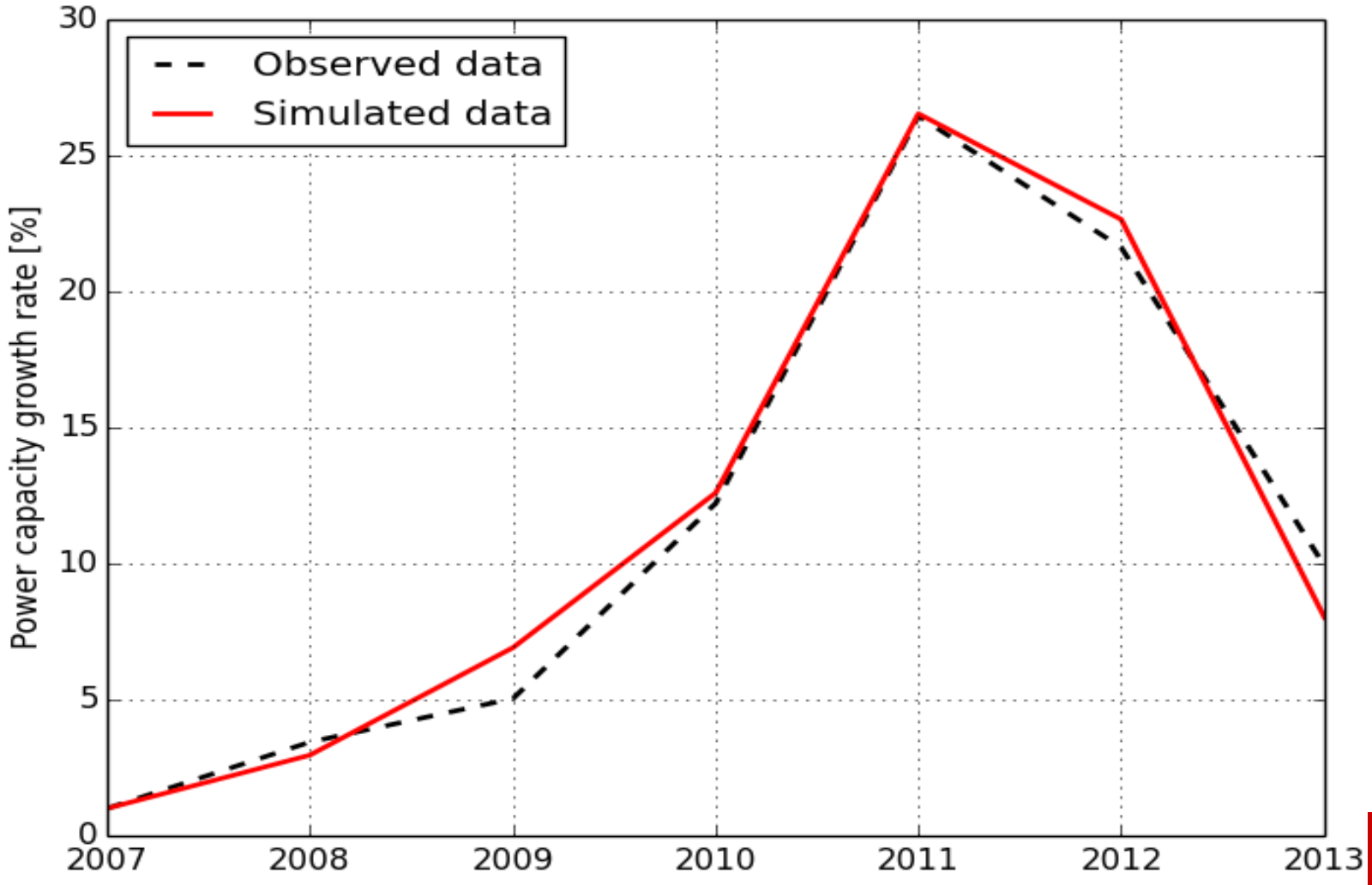
- We simulate the behaviour of single households and government entities (*micro*-level) to study and understand emergent phenomena (*macro*-level)

Proposed Approach (2)

- We consider several factors:
  - Economic aspects (Return On Investment, family income, etc.)
  - Geophysical aspects (position, roof available, etc.)
  - Social aspects (imitation, network effect, etc.)
- Consequently we must calibrate several parameters (the social ones in particular) → we employ automatic parameters tuning techniques
  - Comparison with past data from Emilia-Romagna Region to check the validity of our results

Results

- Real VS simulated trends in PV power installation (ER)



Conclusion

- We proposed an agent-based model to simulate the diffusion of PV systems
- Model fine tuned using past data
- Good Results
  - It’s probably still possible to reduce the margin of error
- Future research directions:
  - Test new calibration methods
  - Test with different datasets
  - Scale-up the number of agents in the model

That’s all

Thanks!

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