

Shaking an Invisible Hand

Carlo Jaeger
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Overview

- 1) Theories of Value: Scarcity vs Coordination
- 2) A Template for Multi-Agent Economies
- 3) Towards a Research Program

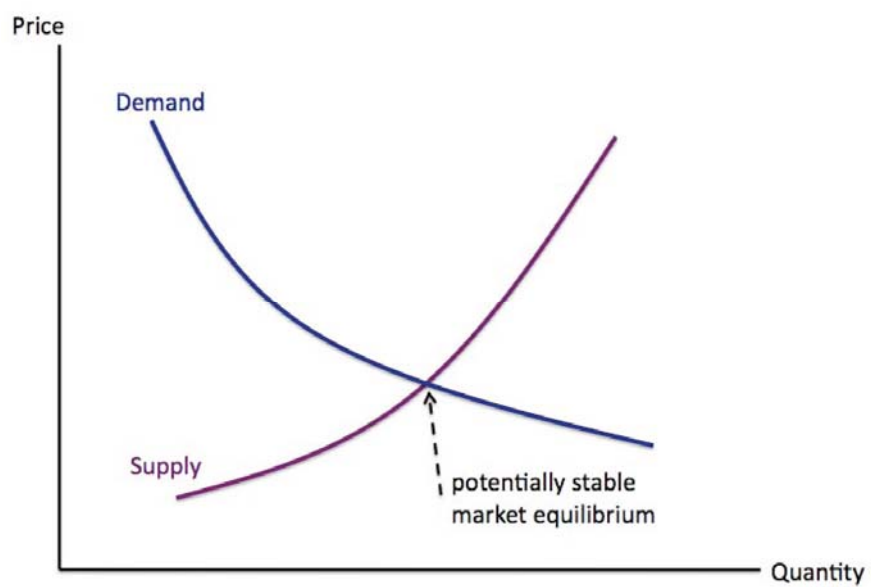


Guiding metaphors

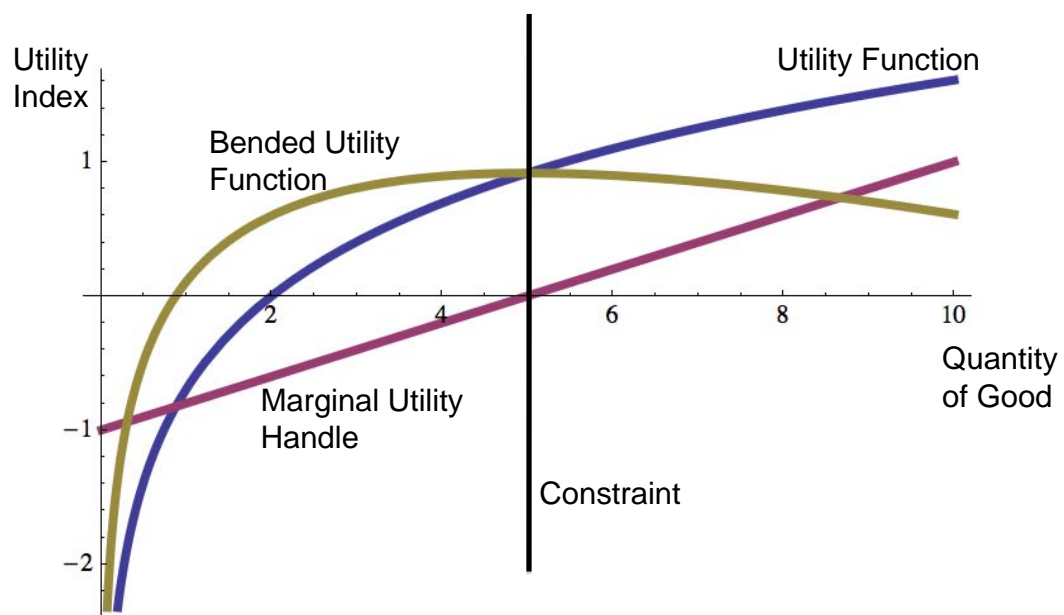
- Darwin's picture of the evolution of species has shaped modern civilization, inspired biological research, and laid the ground for biotechnology.
- Smith's image of the invisible hand of the market has shaped modern civilization, inspired economic research, and laid the ground for economic policy.
- A story from a party.



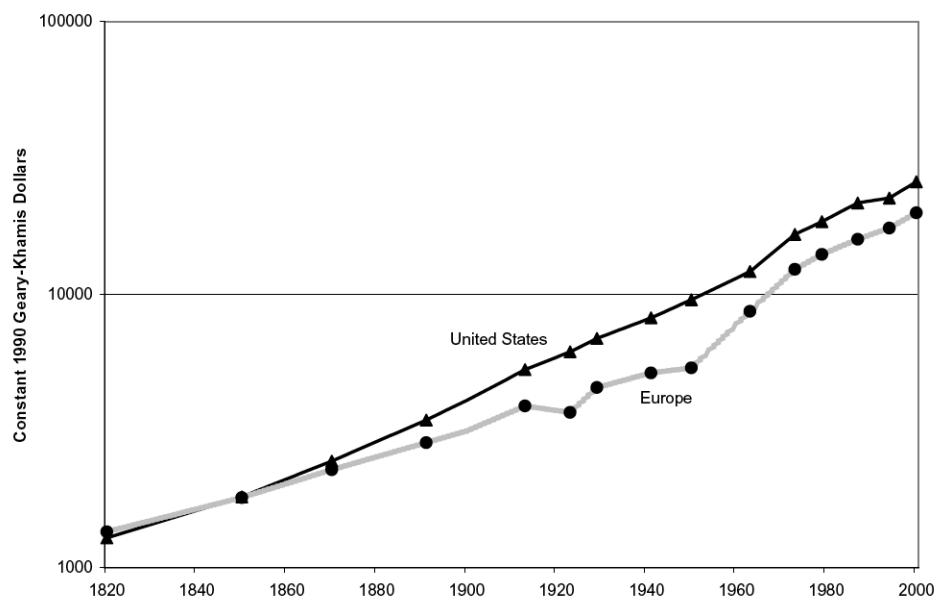
Picture of an invisible hand



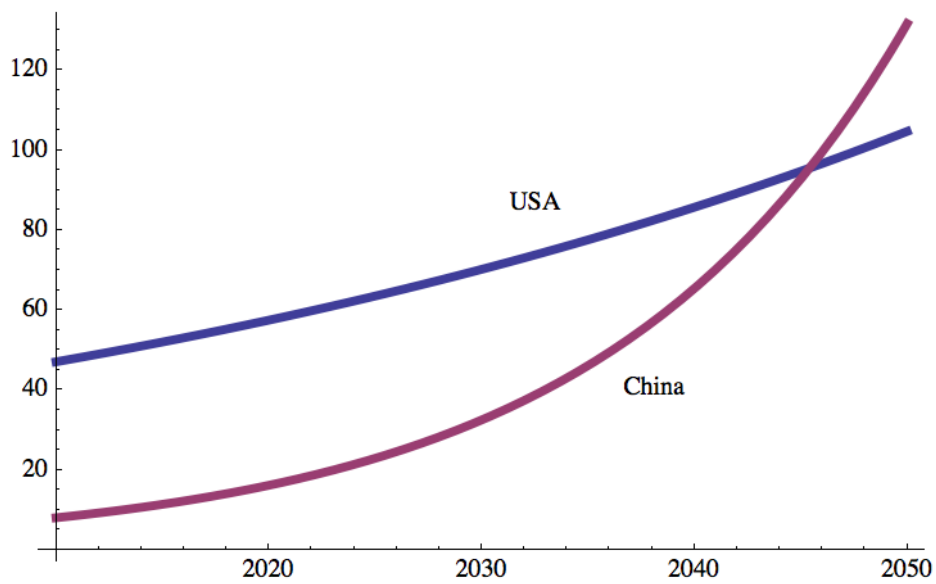
Scarcity



US & Europe real GDP pc, 1820-2000



US & China – the gathering storm?



Keynes was once asked:

„Why is there no theory of value in your General Theory?“

His answer – in a world shaped by supply and demand thinking – :

„Because the only candidate we have – the labor theory of value – is wrong.“

2011 footnote: We better sort out the micro-implications of a global liquidity trap before we have it – we are getting close...



Coordination

0	3
0	3
1	0
1	0

Agents

Let $\mathcal{A} \subset \mathbb{R}^n$ be the state space of an economic agent. It includes resources the agent may own and strategies she may use – e.g. prices and quantities she accepts for transactions. \mathcal{A} includes the null vector in \mathbb{R}^n , which is used as a placeholder for agents that do not yet or no more exist.

Let \mathbf{A} be the set of finite lists of states of agents. A list of n states is designated A^n .

An agent n is a function $f_n : \mathbf{A} \times X \rightarrow \mathcal{A}$ giving her state at time $t + 1$ as a function of the agents she can observe at time t and of a random variable X . The random variable represents mistakes and experiments made by the agent.



Observability and economic states

Let \mathcal{M} be the set of square matrices composed of 1 and 0 with the main diagonal composed of 1. An element of \mathcal{M} with n rows is designated $M^{(n)}$; it describes observability relations between agents. Agent i can observe agent j if and only if the entry at the intersection of the i -th row with the j -th column is 1.

A state of an economy is an ordered pair $\langle A^n, M^{(n)} \rangle$. It indicates the agents existing at a given moment in time together with their states and their observability relations. We denote the set of possible economic states as S .



Economic Dynamics

An economy is a function $\phi : S \times X \times Z \rightarrow S$ (X, Z are random variables) with the following properties:

- ◇ each agent n evolves according to her function f_n ;
- ◇ an agent disappears from the system if and only if her function yields the null vector - i.e. she dies or goes bankrupt.
- ◇ if an agent is born or founded, her previous state is represented as a null vector. The function ϕ determines under what conditions new agents emerge.
- ◇ the observability matrix at time $t + 1$ is a function of the state of the economy at time t and the random variable Z .



Coordination Patterns

The function f_n of any agent is such that she imitates strategies of other agents that she perceives to be particularly successful.

What counts as success, however, depends on the overall state of the economy.

As a result, agents engage in iterated coordination games, where situations of equal success for all agents form basins of attraction that are only rarely transgressed.



Gintis models with growth

- **A proof of concept has been achieved by successfully implementing multi-agent models of interdependent markets with an arbitrary number of agents and sectors.**
- **The models allow for multi-sectoral growth, they include finance and credit.**
- **‚Sucessfully‘ means that the models can reproduce key features of actual economies by selecting one of several possible equilibria.**
- **Relevant features include exponential growth, irregular business cycles and stochastic dynamics around patterns of relative prices with considerable inertia.**



Taking stock

- Often, multi-agent economies can be studied as finite Markov processes.
- Market prices vary among different transactions.
- Agents observe samples of actual and proposed transactions.
- Agents engage in trial and error, and they imitate others whom they perceive as successful.



Proposition 1:

- **The world economy is an evolving network of heterogeneous agents.**
- (Special case: A population of homogeneous agents)



Proposition 2:

- **In a world of on-going change, these agents try to create viable patterns of activities.**
- (Special case: intertemporal optimization)



Proposition 3:

- **Normal prices operate as conventions that solve coordination problems via markets.**
- (Special case: public prices announced by an auctioneer)



Proposition 4:

- **Contemporary markets are embedded in an evolving global fabric of social norms**
- (Special case: single government providing public goods)



Summary of initial propositions

- I. A global network of heterogeneous agents**
- II. The search for viable patterns of activities**
- III. Normal prices and convention dynamics**
- IV. Markets and social norms**



A Few Practical Steps

- I. Build alliances with other disciplines**
- II. Link our work with practically relevant debates about global systems.**
- III. Document a research program on global systems.**
- IV. Combine use of ,internal‘ and ,external‘ journals.**
- v. An opportunity: GSDP annual conference, October 10/11 in Berlin.**

