On the informational efficiency of markets

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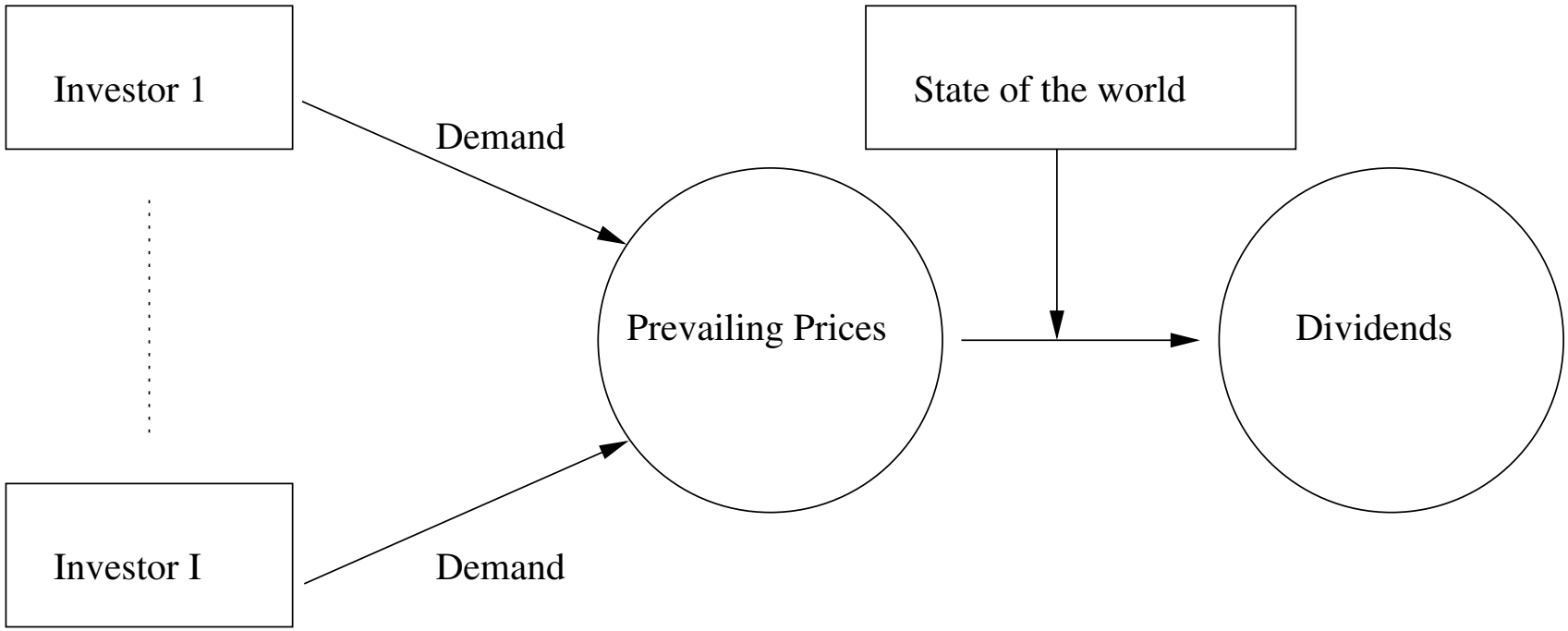
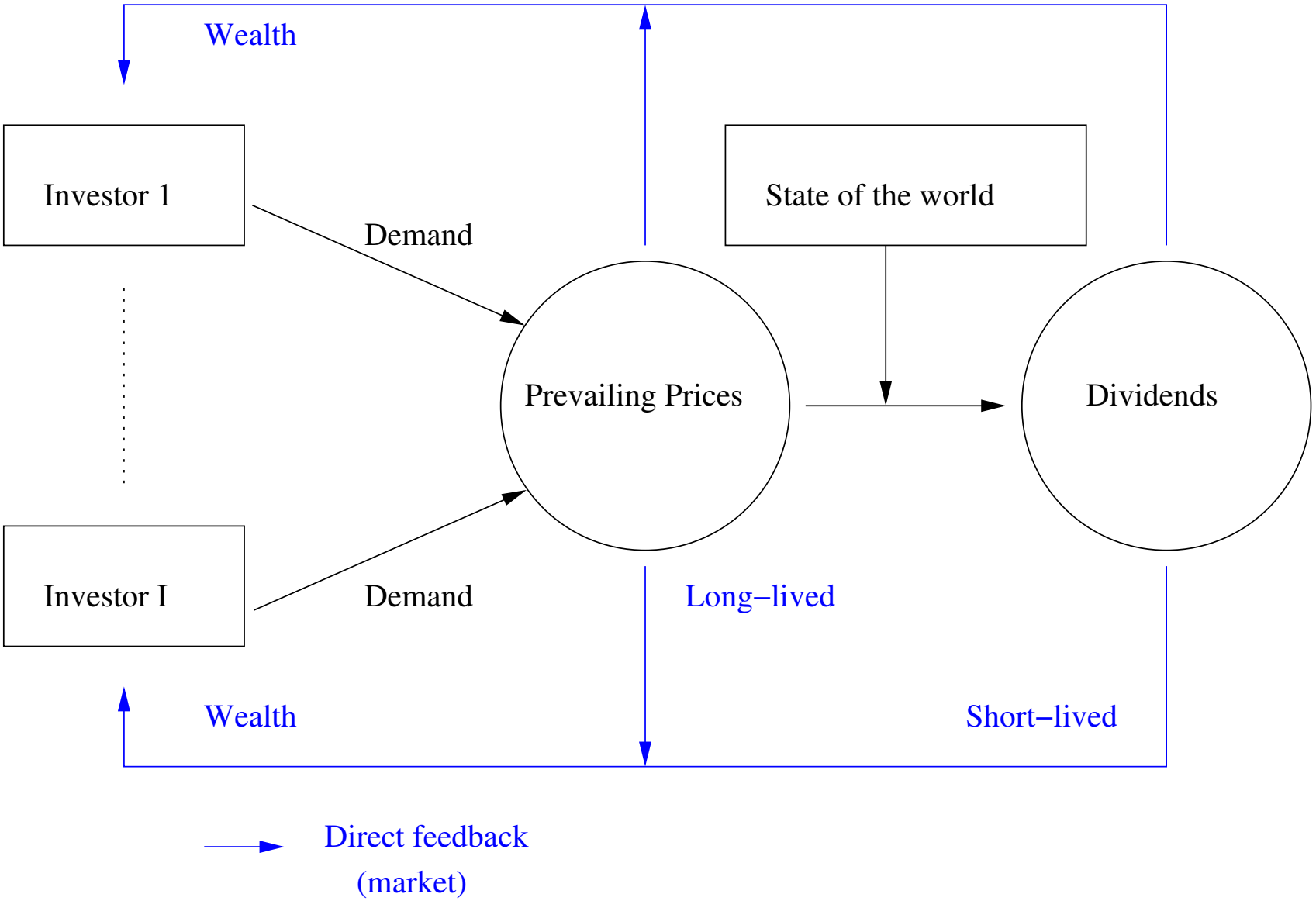
Toward an alternative macroeconomic analysis of microfundations, finance-real economy dynamics and crisis
Budapest, 6-8 September 2010

Asset market and feedbacks



Asset market and feedbacks



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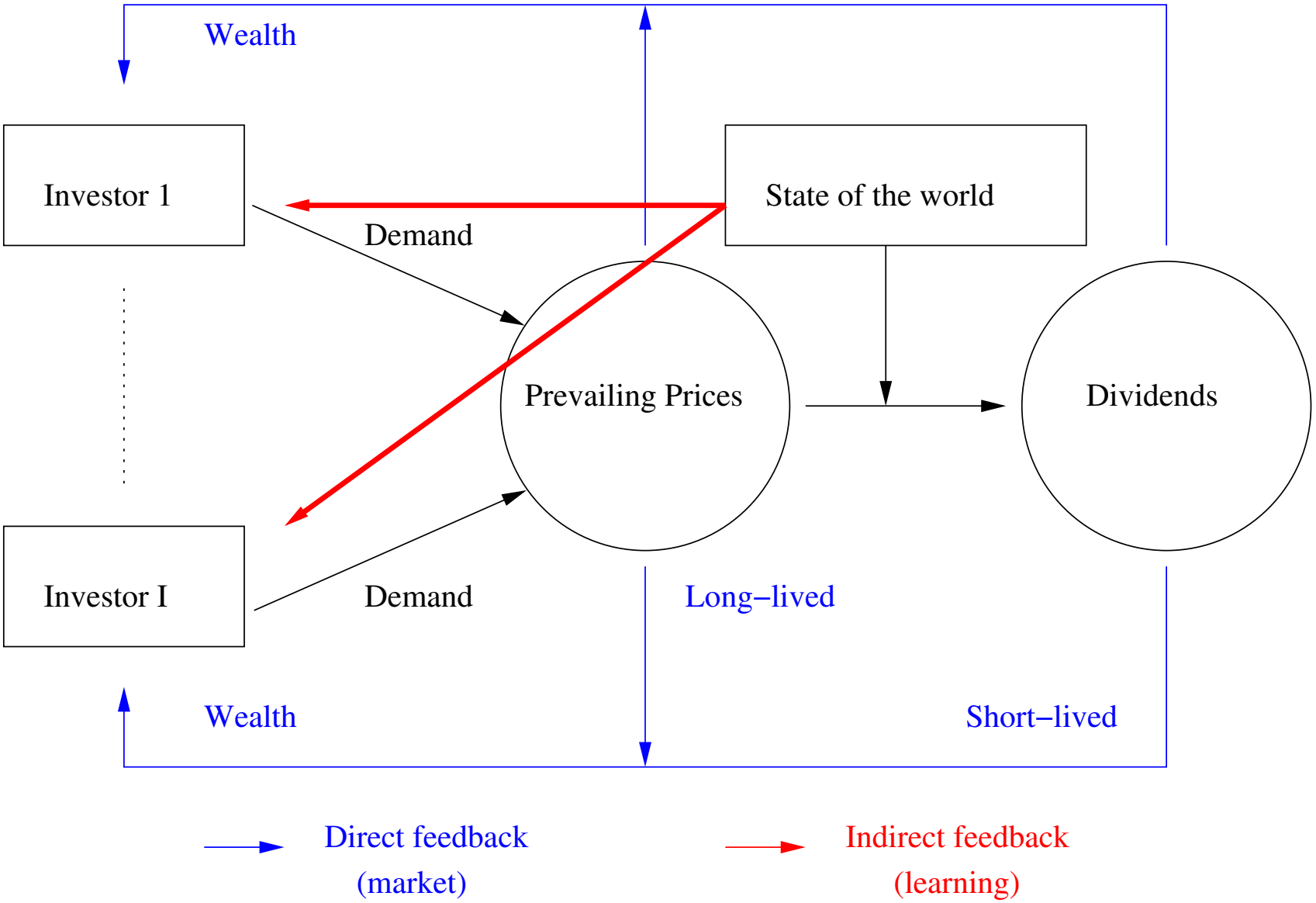

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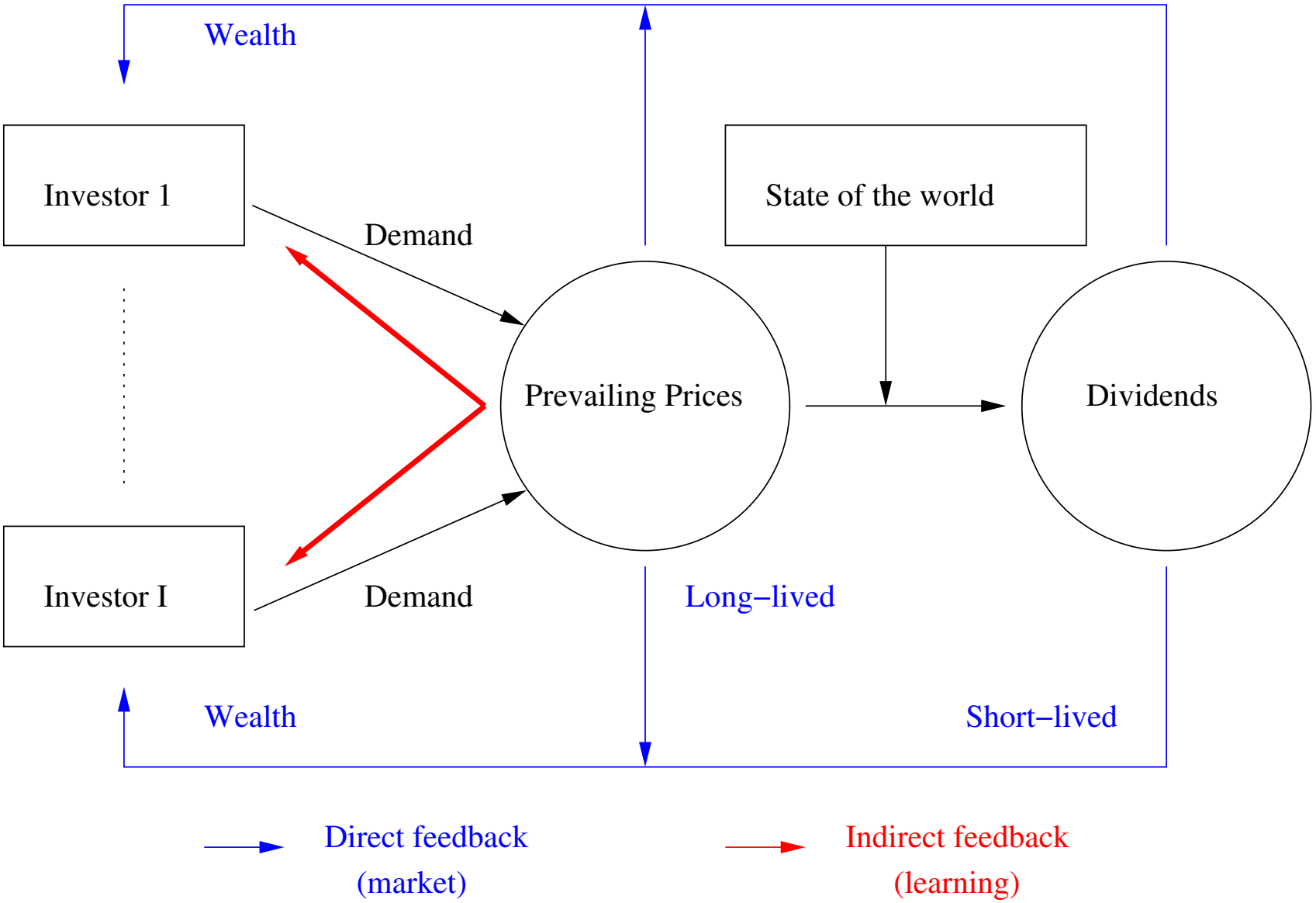


The message

As soon as (current, expected or realized) prices enter in the investment decisions of agents, the market can display multiple and stable long-run equilibria or persistent oscillatory dynamics.

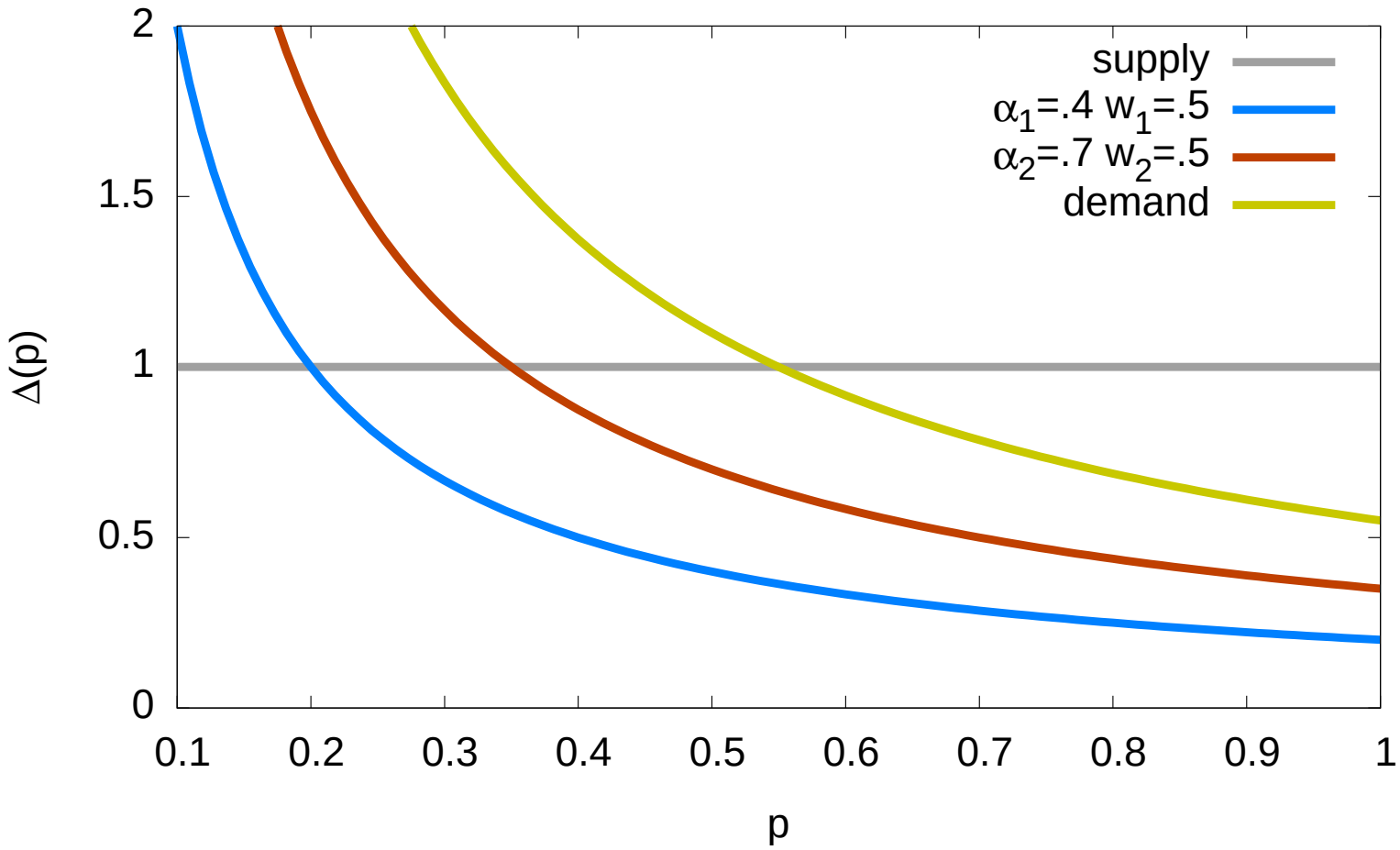
These long-run equilibria lead to informational inefficiency.

We proved these proposition true in a GENERAL EQUILIBRIUM MODEL even without frictions, adjustment/information costs or informational asymmetries.

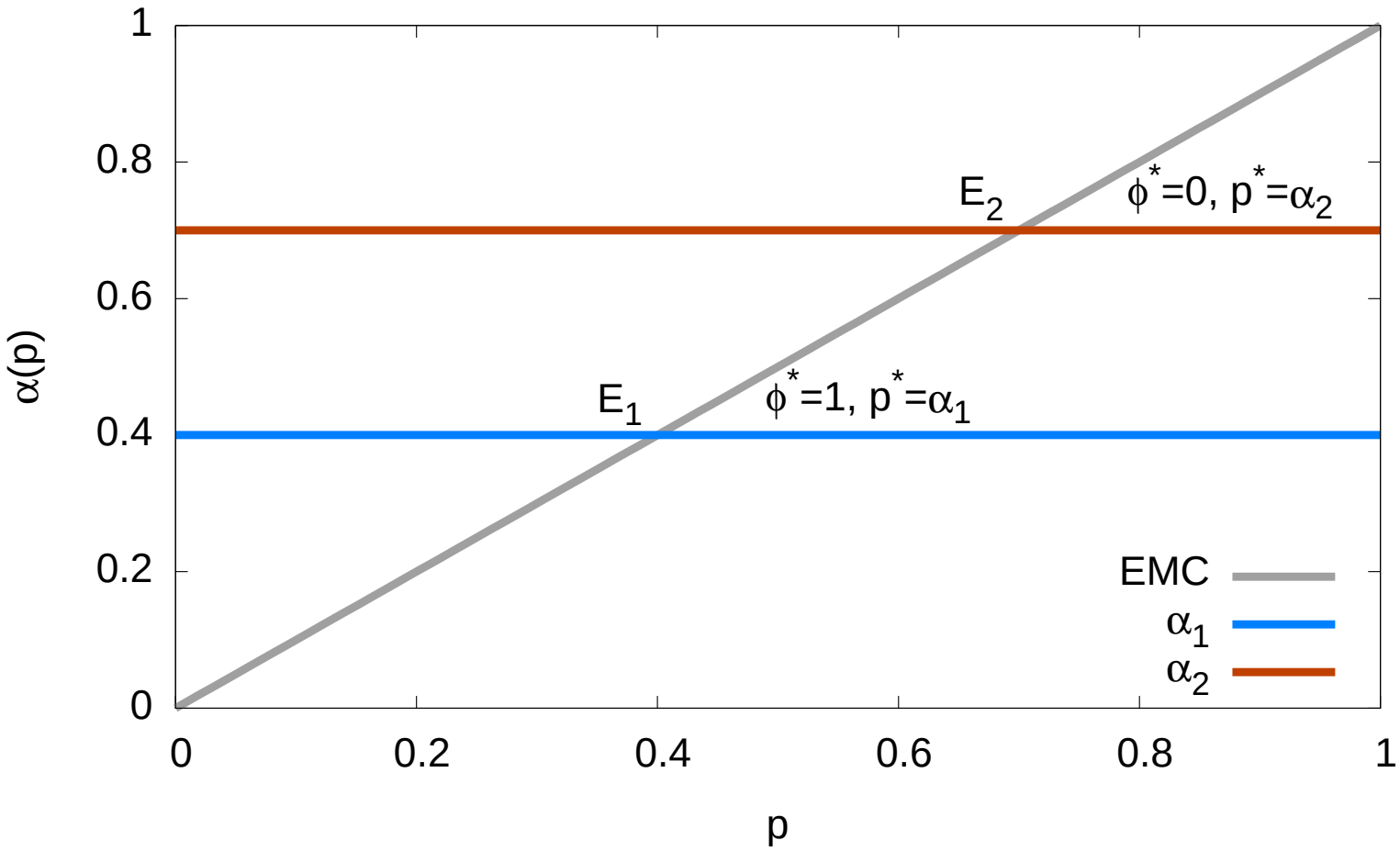
- Two states of the world, $s = 1, 2$, which occur with probability π and $1 - \pi$ in a Bernoulli process.
- Two (short-lived) Arrow securities, $k = 1, 2$ in unit supply. Security k pays 1 is state of the world k is realized, 0 otherwise.
- Two agents, $i = 1, 2$, with wealth $w_{i,t}$. Let $\alpha_{i,t}$ be the fraction of wealth that agent i invests in security 1 at time t. $1 - \alpha_{i,t}$ is invested in security 2. No consumption WLOG.

Walrasian price-fixing of asset 1 at time t (dropping time index)

$$1 = \frac{\alpha_1}{p_1} w_1 + \frac{\alpha_2}{p_1} w_2$$



$$p_1 = \alpha_1 \phi_1 + \alpha_2(1 - \phi_1) \quad \text{with} \quad \phi_i = w_i/(w_1 + w_2).$$



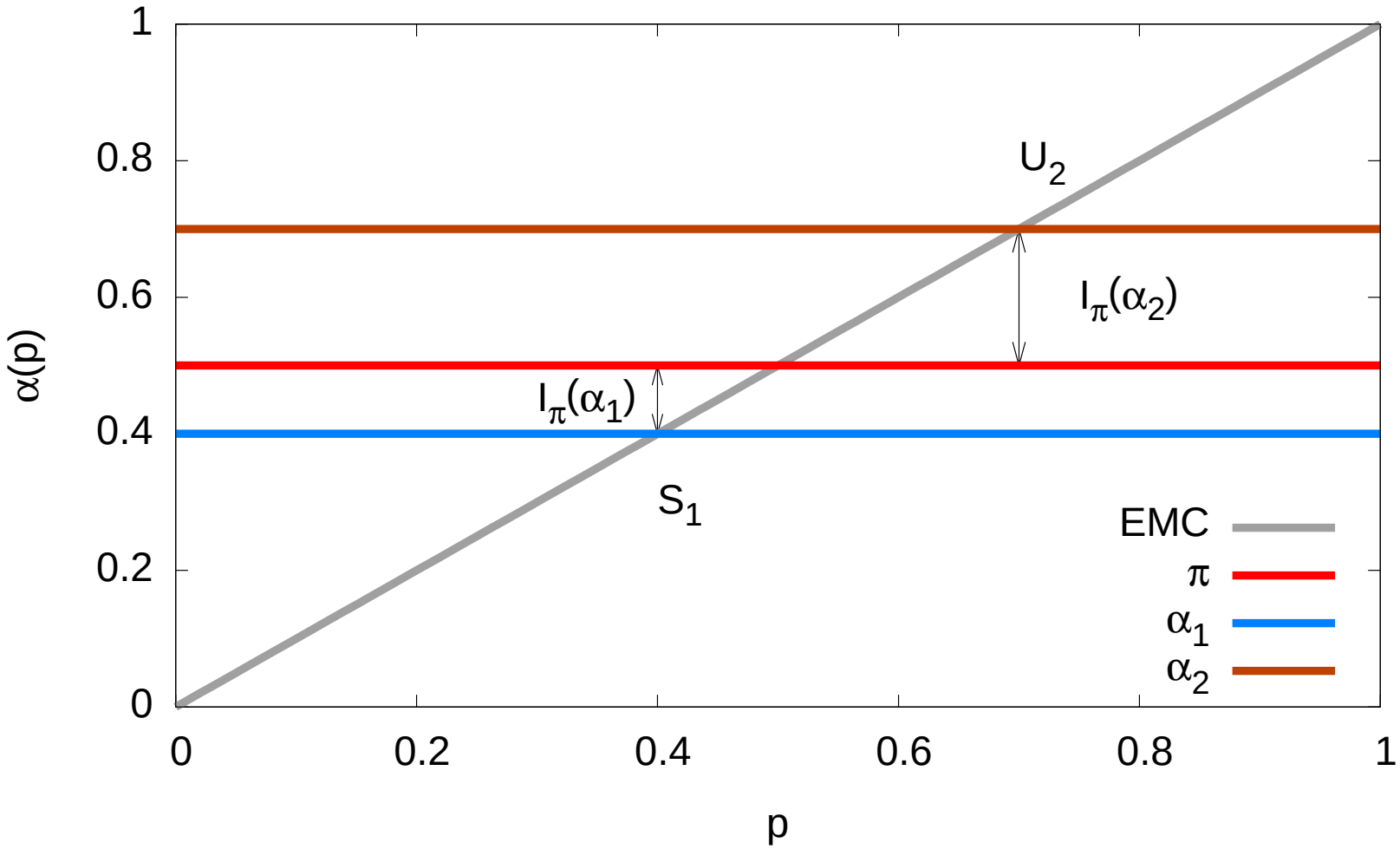
Suppose αs are constant, where does the market converge? *E*s are the only fixed points.

Consider the relative entropy of investment strategy w.r.t. the true probability measure

$$I_i(\alpha_i) = \pi \log \frac{\pi}{\alpha_i} + (1-\pi) \log \frac{1-\pi}{1-\alpha_i} \ .$$

$I_i \geq 0$ represents information loss: the lower, the grater the agreement of the strategy with the true process.

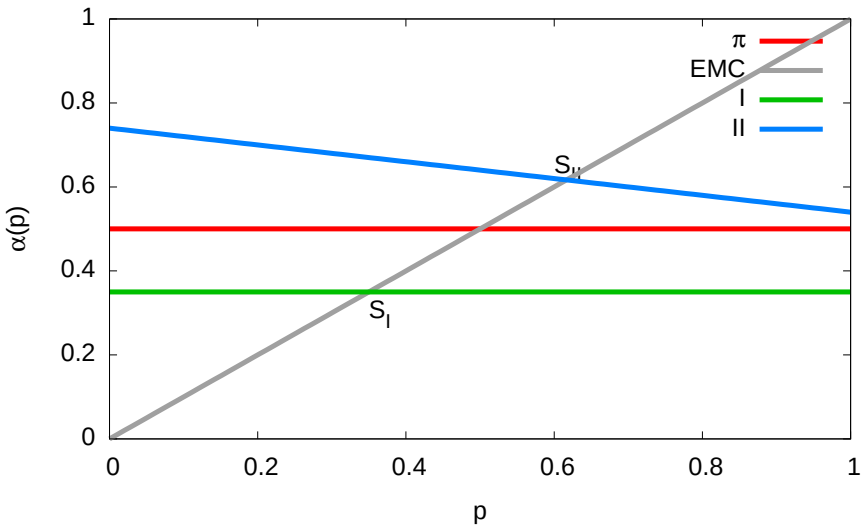
I_i it represents a sort of distance from the "probability" line in the EMC plot.

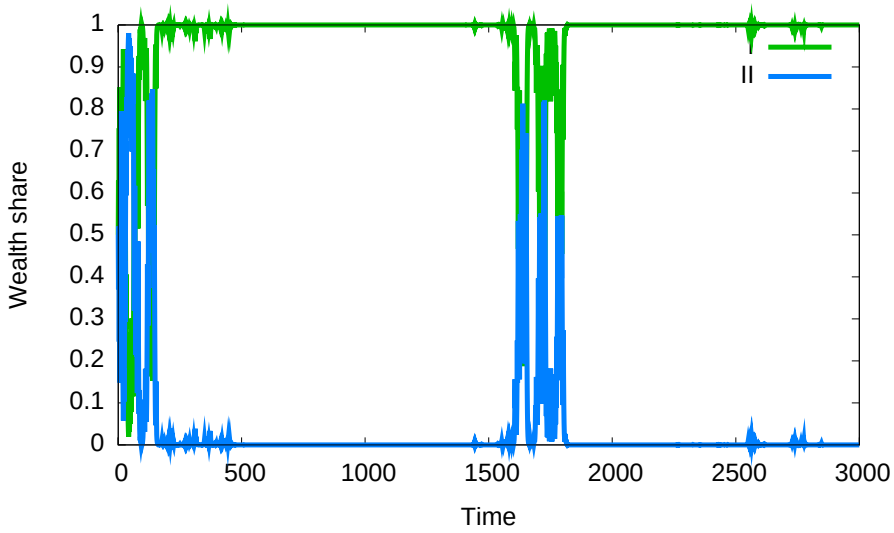


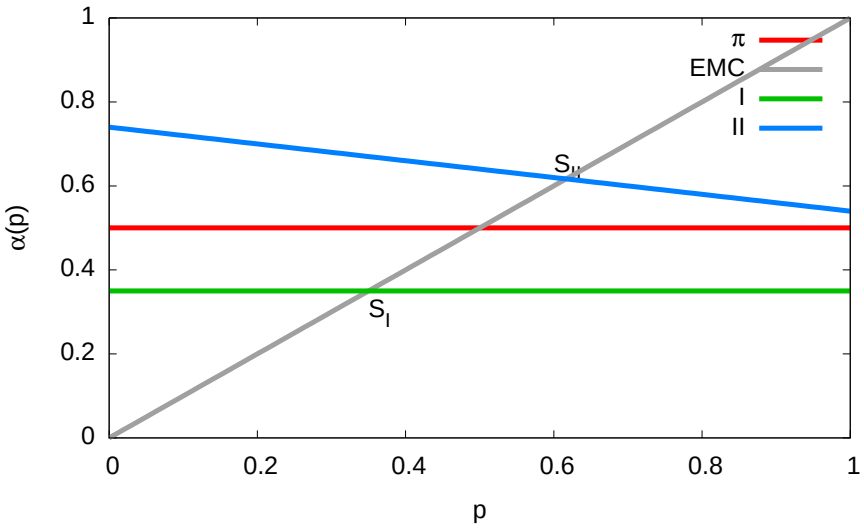
The only stable equilibrium is the one in which the best informed agent survives (S_1).

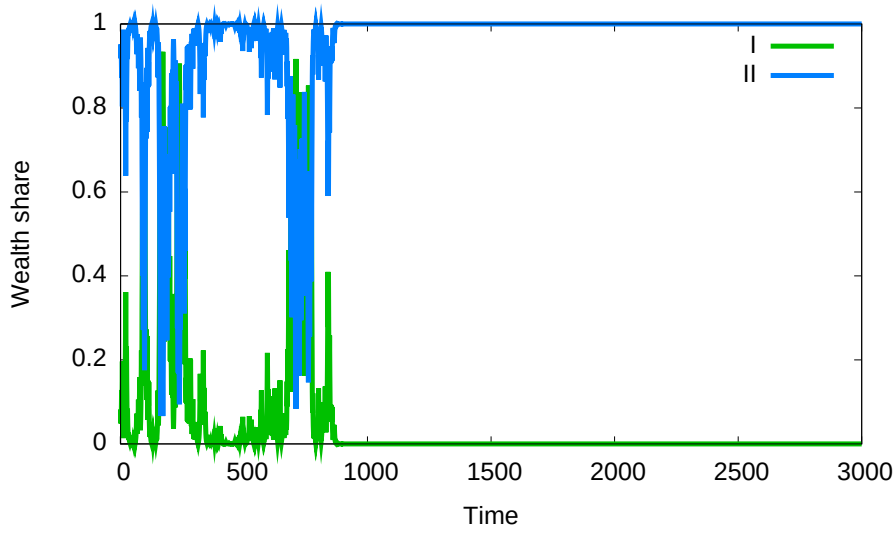
αs can contain price dependence because:

- In the example above, prices reflect best information. Why not use them?
- Prices is what we know in real markets (unobservable or not-stationary “fundamental” process)
- Preferences can be different from log-utility.


1
0.8
0.6
0.4
0.2
0
α(p)
0
0.2
0.4
0.6
0.8
1
p
π
EMC
I
II
S_II
S_I


1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Wealth share
0
500
1000
1500
2000
2500
3000
Time
I
II


1
0.8
0.6
0.4
0.2
0
α(p)
0
0.2
0.4
0.6
0.8
1
p
π
EMC
I
II
S_II
S_I


1
0.8
0.6
0.4
0.2
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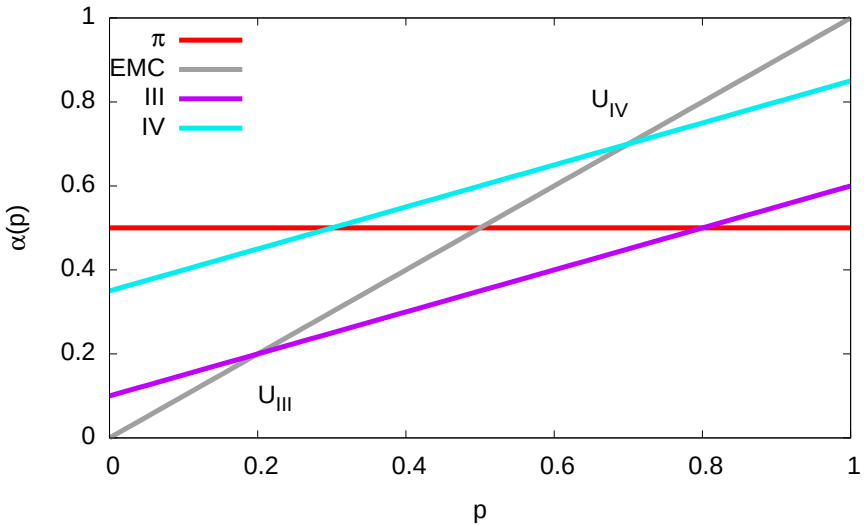
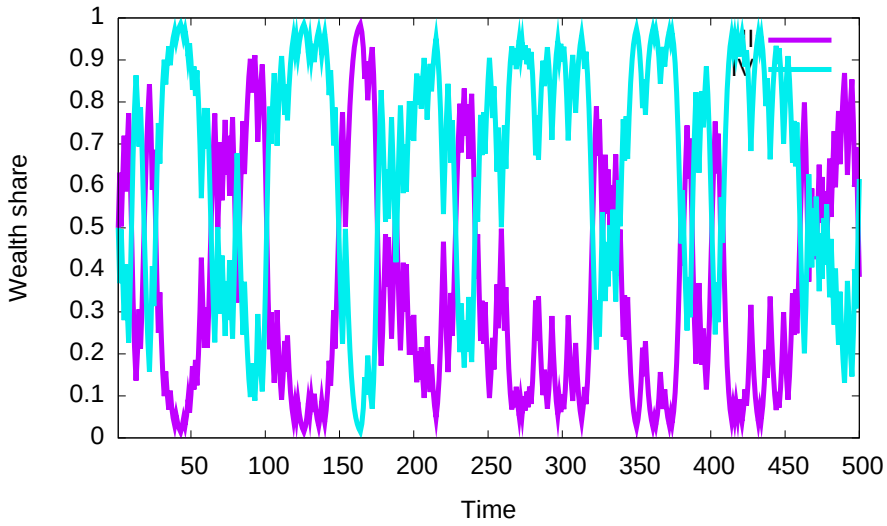
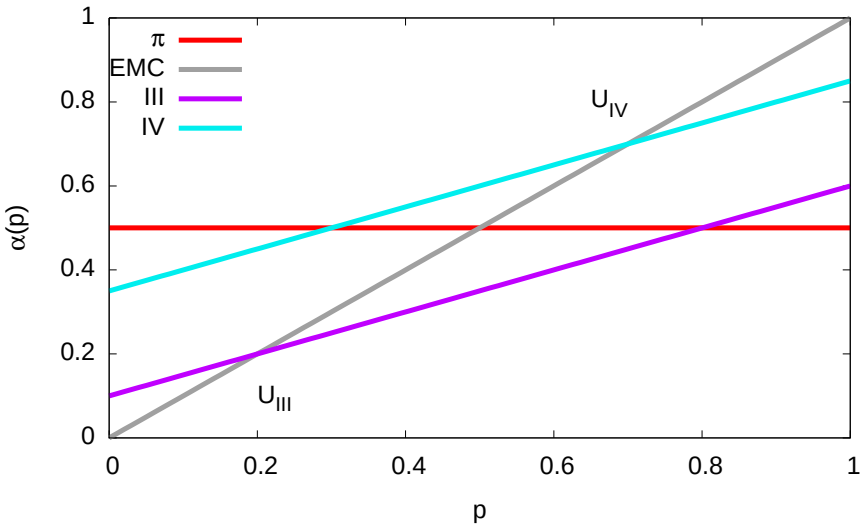
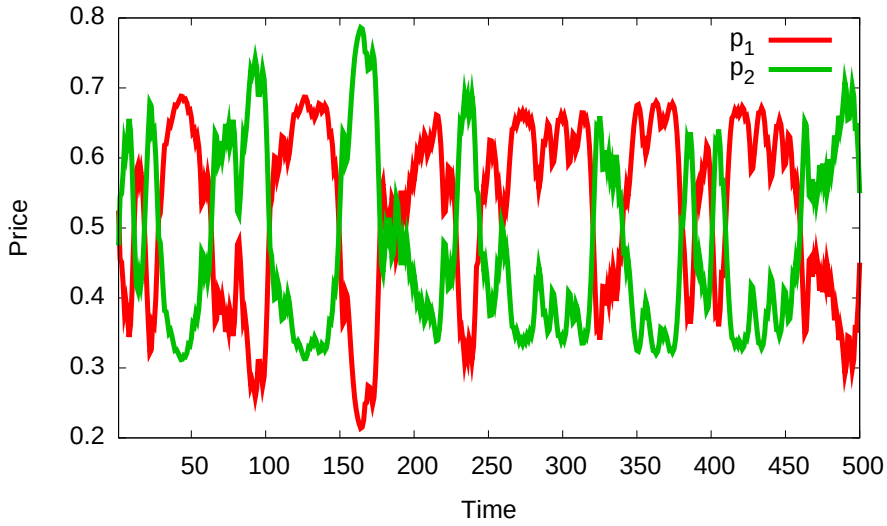
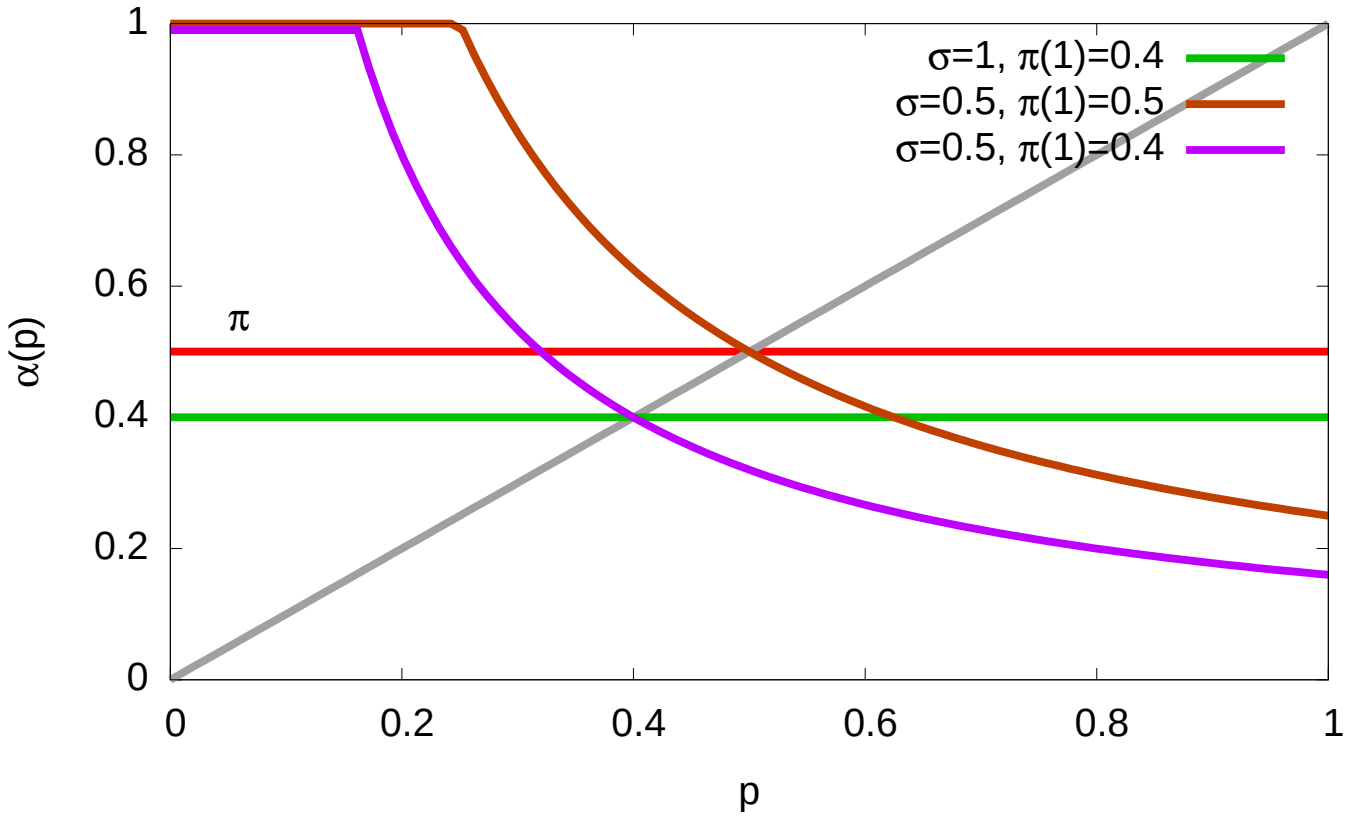
Wealth share
0
500
1000
1500
2000
2500
3000
Time
I
II


π
EMC
III
IV
U_{IV}
U_{III}
α(p)
p
0
0.2
0.4
0.6
0.8
1


Wealth share
Time
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
50
100
150
200
250
300
350
400
450
500


π
EMC
III
IV
U_{IV}
U_{III}
α(p)
p
0
0.2
0.4
0.6
0.8
1


p_1
p_2
Price
Time
0.2
0.3
0.4
0.5
0.6
0.7
0.8
50
100
150
200
250
300
350
400
450
500



$$U = \left\{ \gamma \sum_S \pi(s) u(c_1(s)) + \gamma^2 \sum_S \pi(s) u(c_2(s)) + \ldots \right\}, u(c) = \frac{c^{1-\sigma}}{1-\sigma}$$

Max$U$ given budget implies $\alpha_k = \left(\frac{\gamma \pi(k)}{p_k} \right)^{\frac{1}{\sigma}} p_k$

- Behavioral Finance (a survey is Barberis and Thaler, 2003)
  - Pros Ecology of strategies behaviorally grounded
  - Cons No wealth-driven strategy selection
  - Focus Market biases
- HAM Finance (a survey is Hommes, 2006)
  - Pros Focus on price feedbacks
  - Cons No wealth-driven strategy selection (mostly CARA), deterministic
  - Focus Stylized facts
- Evolutionary Finance (Kelly, 1956; Blume and Easley, 1992; a survey is Evstigneev, Hens, and Schenk-Hoppe, 2009)
  - Pros Multi-asset stochastic general equilibrium framework
  - Cons Absence of price feedbacks (no endogenous investment rules)
  - Focus Market selection

$\Rightarrow$ Our approach: evolutionary finance with endogenous (price dependent) investment rules.

http://www.lem.sssup.it/paper_seminars/budapest/bottazzi.pdf

Paper at the conference site.

Journal of Evolutionary Economic special issue “Evolution and market behavior in economics and finance”, Bottazzi and Dindo (eds.) forthcoming