

Market Failure caused by Quality Uncertainty

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1 Introduction

2 The walrasian market model

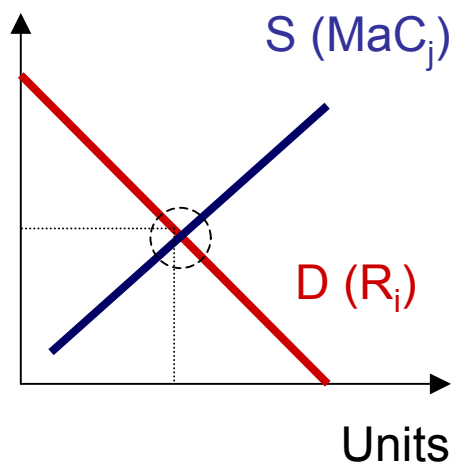
3 The double auction model

4 Conclusions

The Question

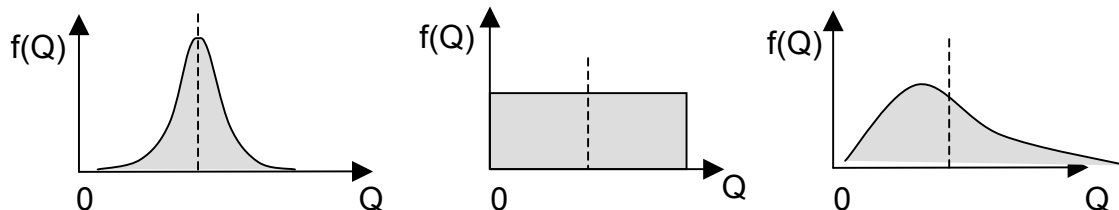
What are the effects of quality uncertainty on the market?

€/unit



From the “perfect competition” model ...
what happens if:

a) Quality is a random variable with a probability distribution



b) Buyers update their expected quality based on the quality of the products they buy

$$\text{e.g.}: \hat{Q}_i^{t+1} = (1 - \lambda) \hat{Q}_i^t + \lambda Q_i^t$$

and reserve values are proportional to the expected quality

Background: The Market for “Lemons”:

Quality Uncertainty and the Market Mechanism (G. Akerlof 1970)

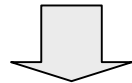
“The single most important study in the literature on economics of information”

Nobel prize 2001

Used cars, insurance policies, warranties

ASYMMETRIC INFORMATION

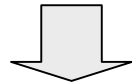
The seller can distinguish between “good-quality” and “bad-quality” items, but the buyer can not distinguish



“Good-quality” and “bad-quality” items are sold at the same price.

“Bad-quality” items are more profitable for the seller, so there is a pressing supply of bad-quality items

**ADVERSE
SELECTION**



Quality and prices go down, and the market may even disappear

Note that this model is based on the expected sellers’ behaviour when there is asymmetric information

1 Introduction

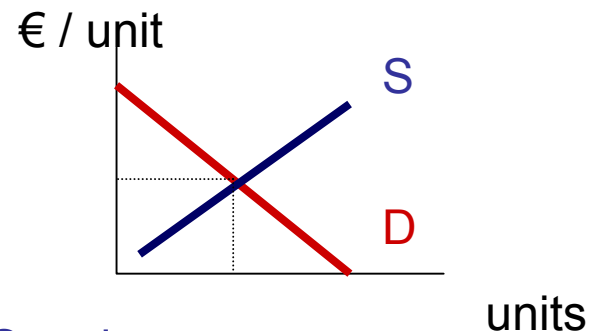
2 The walrasian market model

3 The double auction model

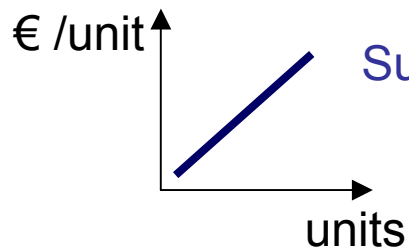
4 Conclusions

The model (I)

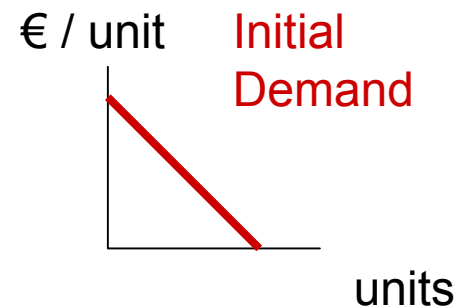
- Walrasian market clearing mechanism
Clearing rounds 0, 1, ..., t, ...



- 100 sellers, a constant supply function



- 100 buyers, each one with an initial reserve value $R_i^0 = i$;



- Reserve values are proportional to the estimated quality

$$R_i^t = R_i^0 \hat{Q}_i^t$$

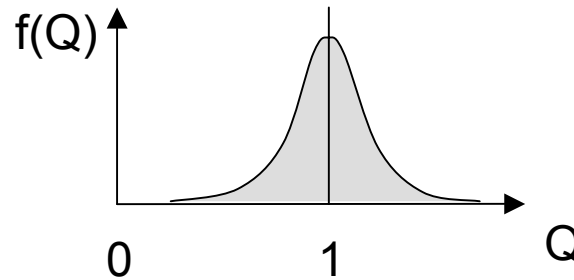
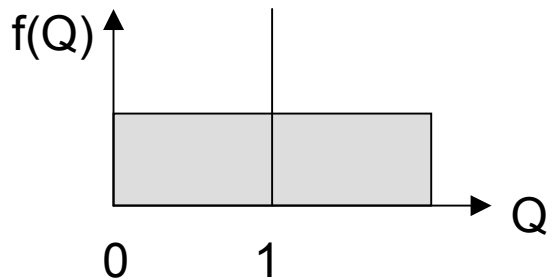
The model (II)

- Estimated Quality $\hat{Q}_i^0 = 1$ is updated when new qualities are observed:

$$\hat{Q}_i^{t+1} = (1 - \lambda) \hat{Q}_i^t + \lambda Q_i^t \quad \text{if a product is purchased}$$

$$\hat{Q}_i^{t+1} = \hat{Q}_i^t \quad \text{otherwise}$$

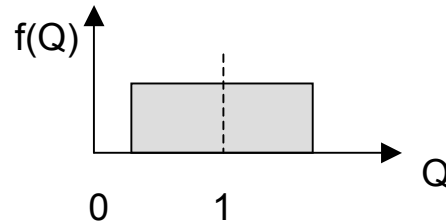
- Different Quality distributions



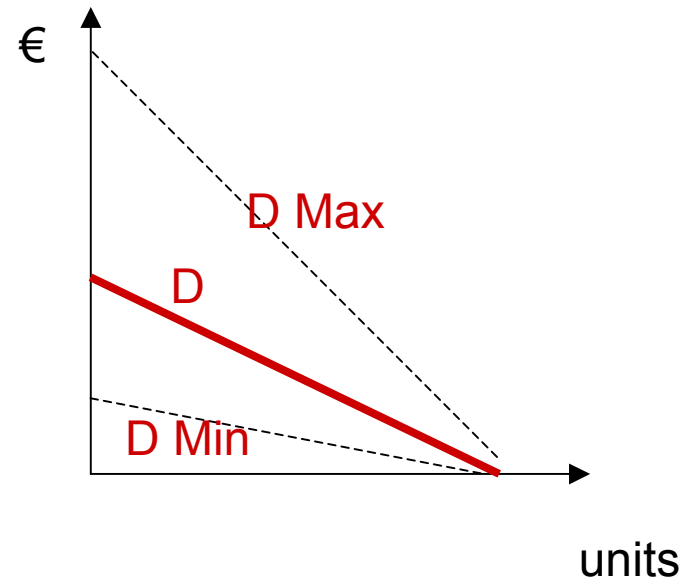
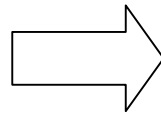
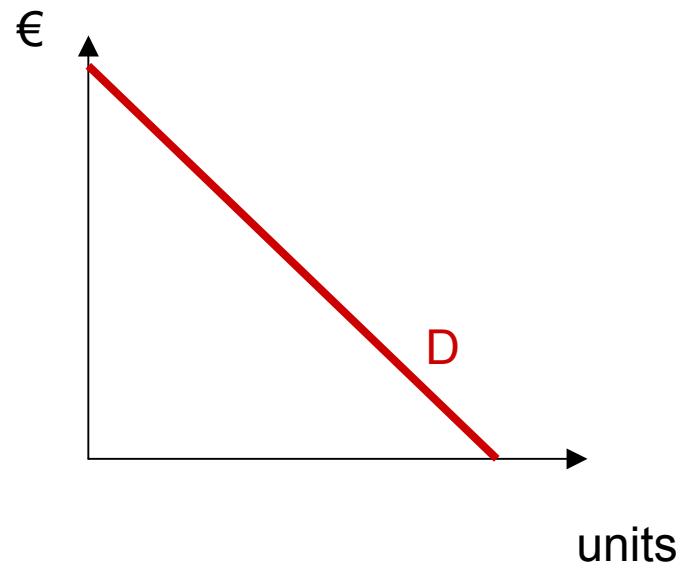
A previous thought

How are the reserve prices (demand) modified by changes in expected quality?

Constant Q

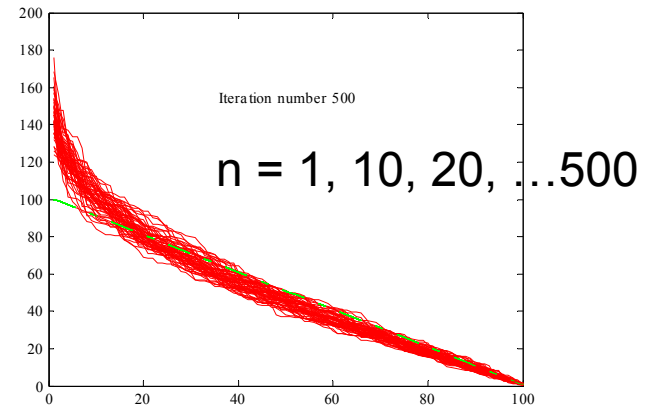
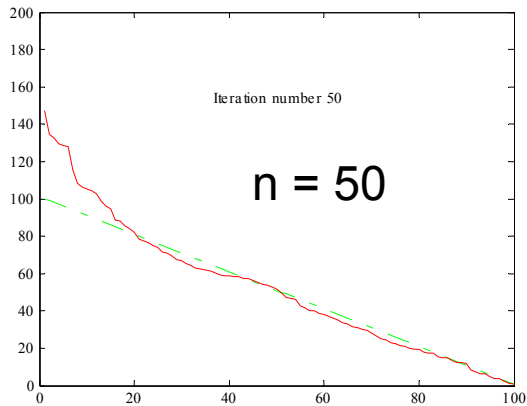
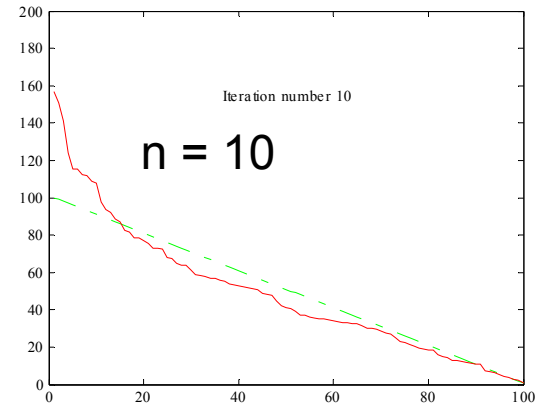
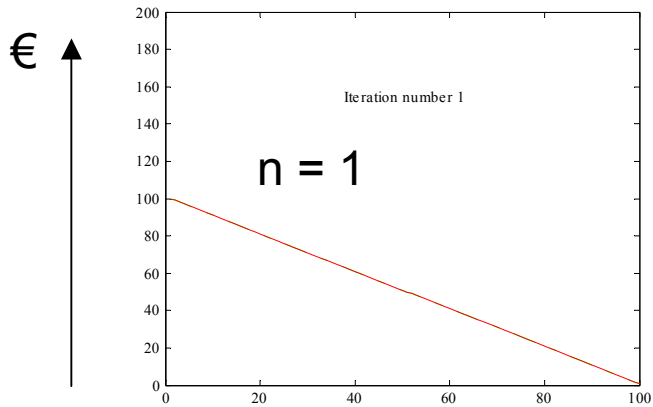


Variable Q



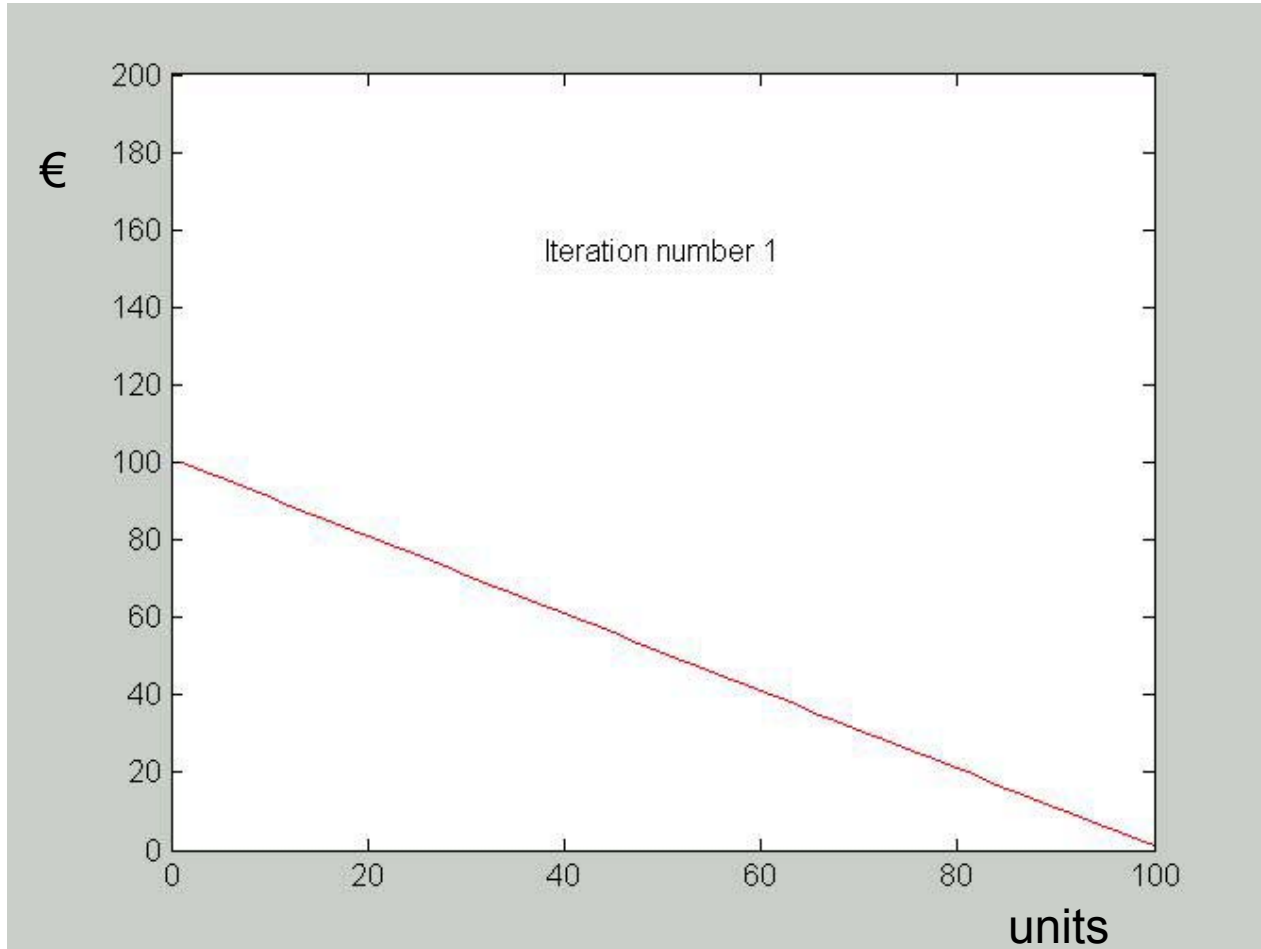
A previous thought

$\lambda = .5$; $Q \sim U[0,2]$ If every buyer got a product ...

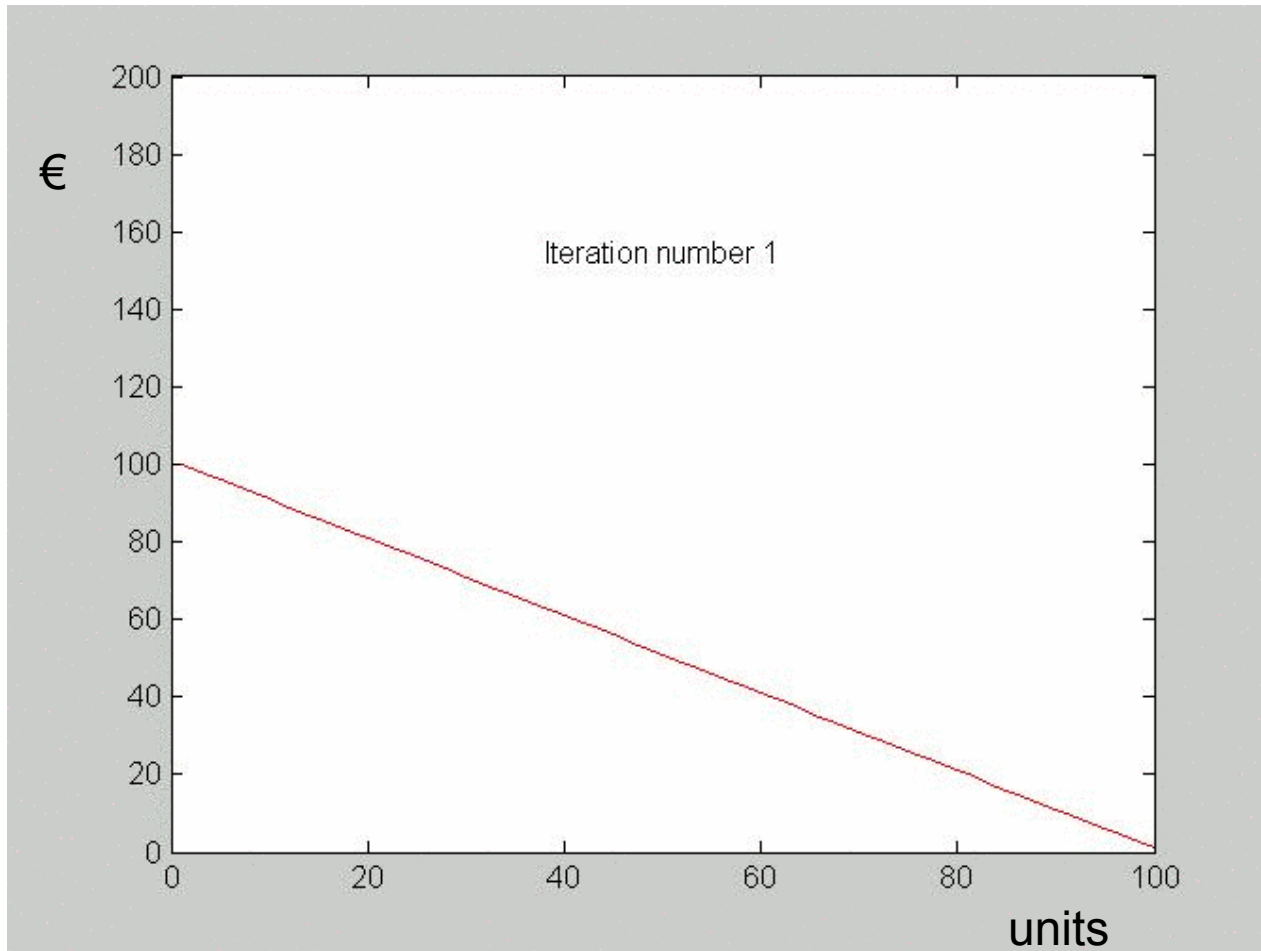


units

A previous thought

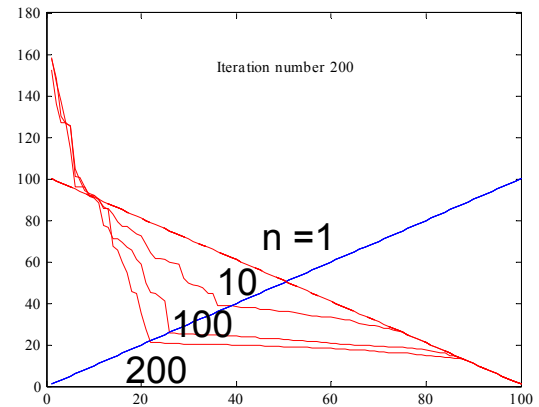
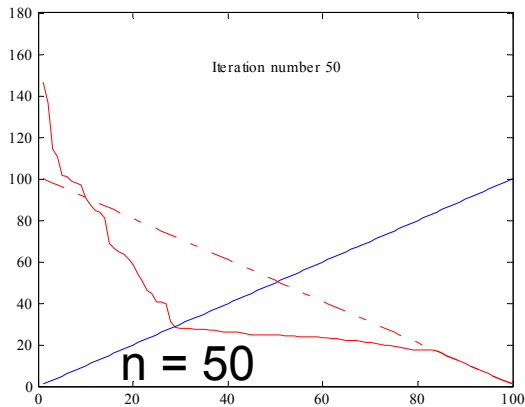
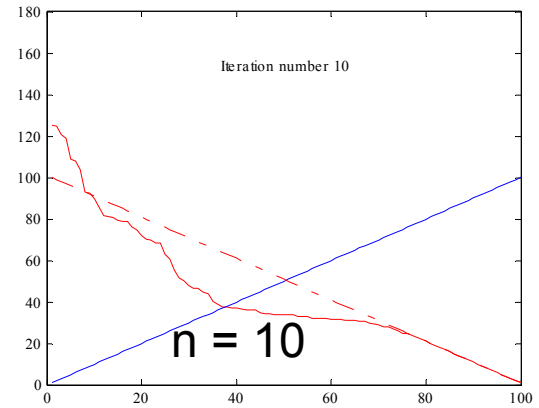
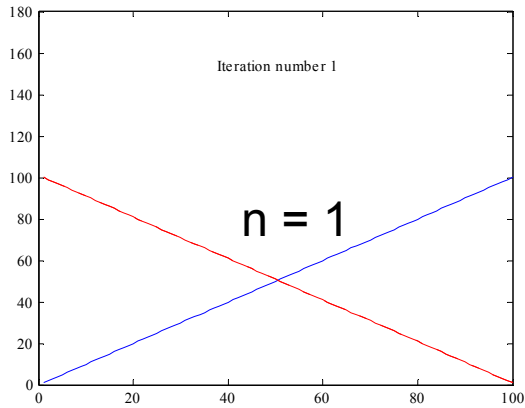


A previous thought



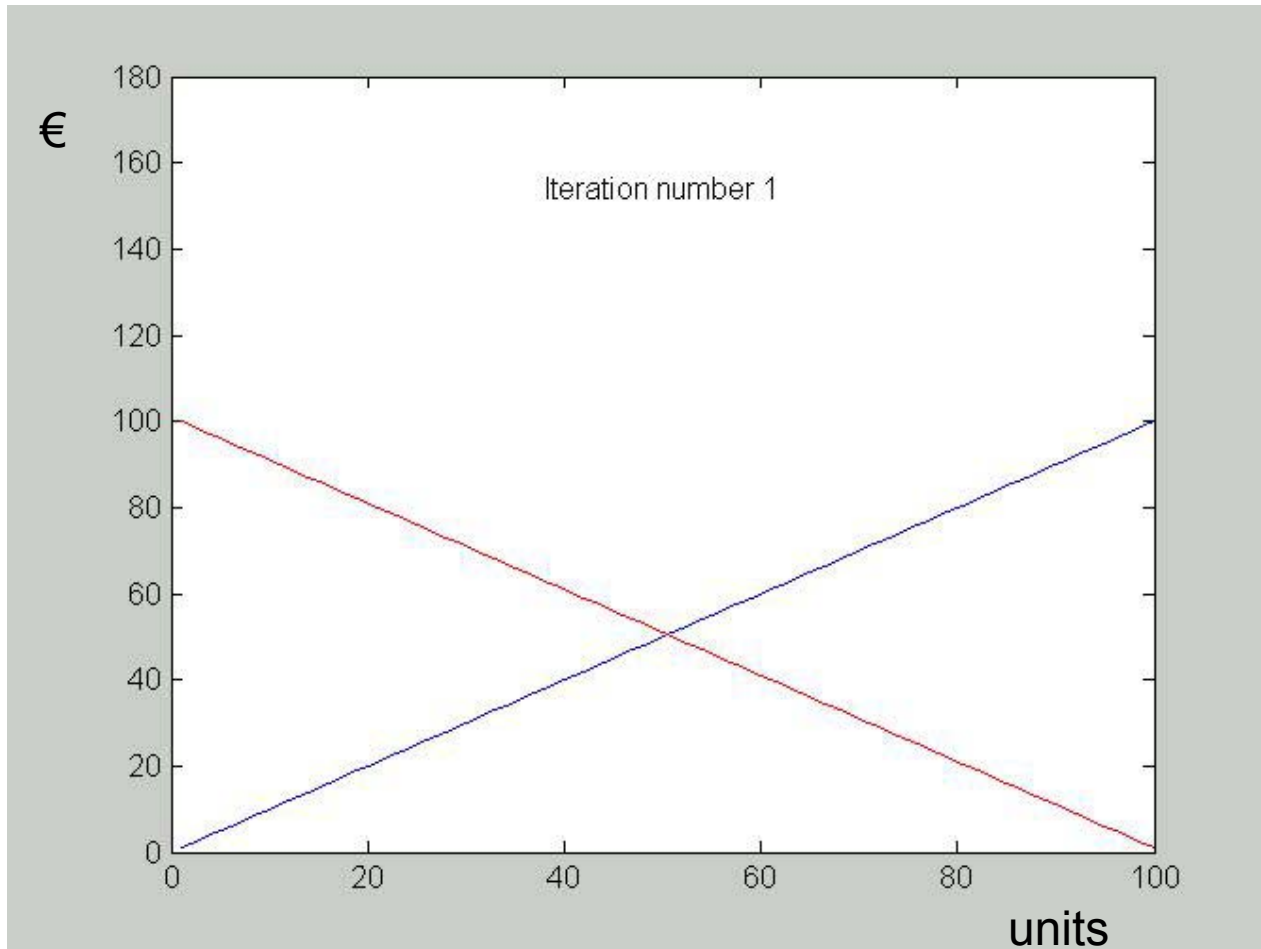
Market Results

€ ↑

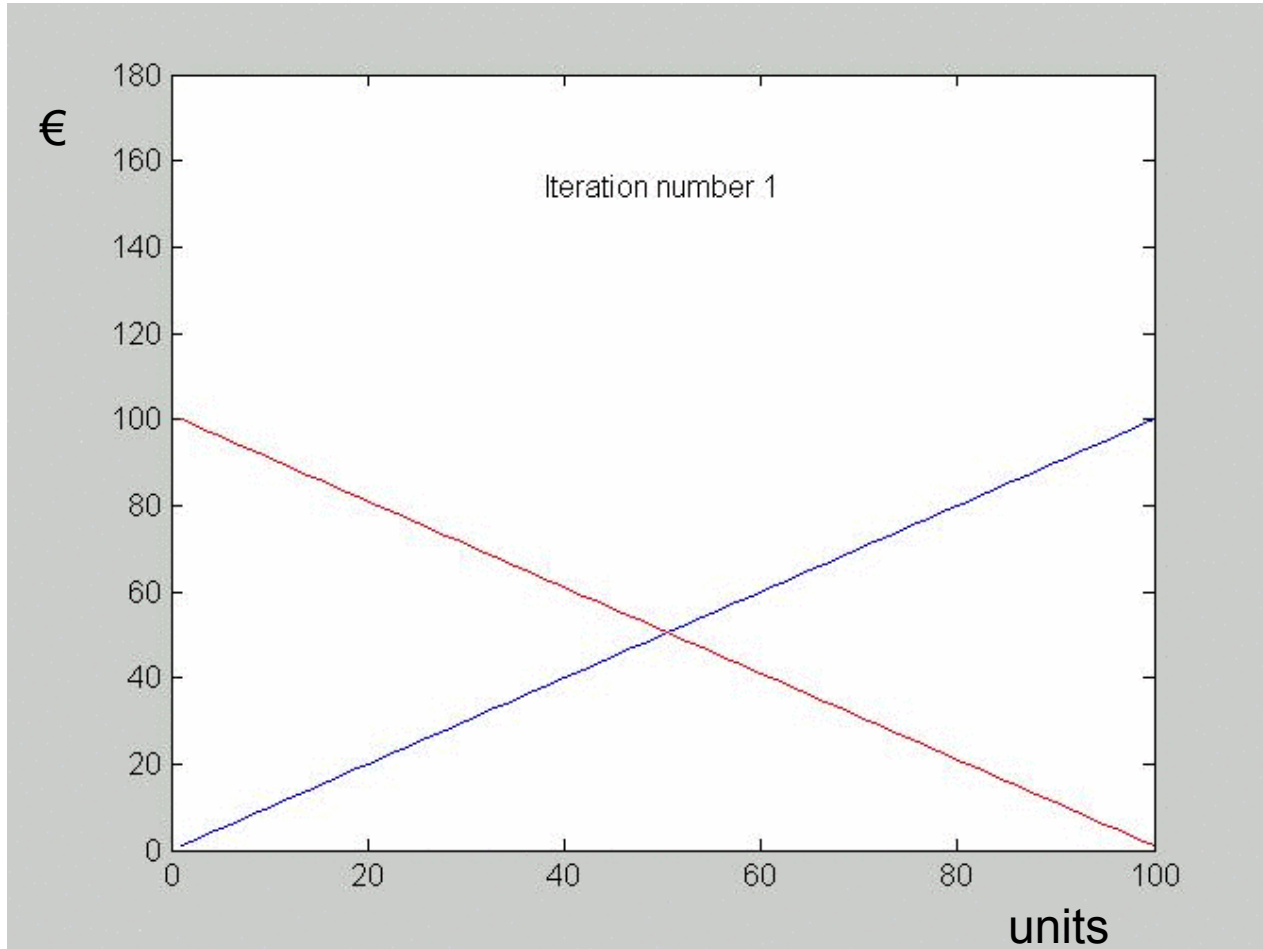


→ units

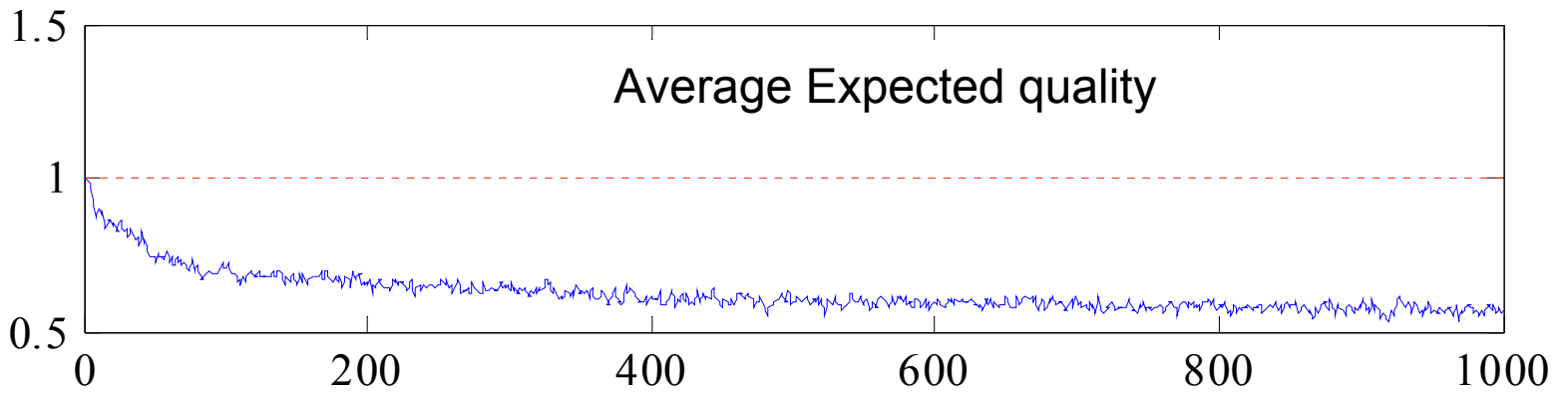
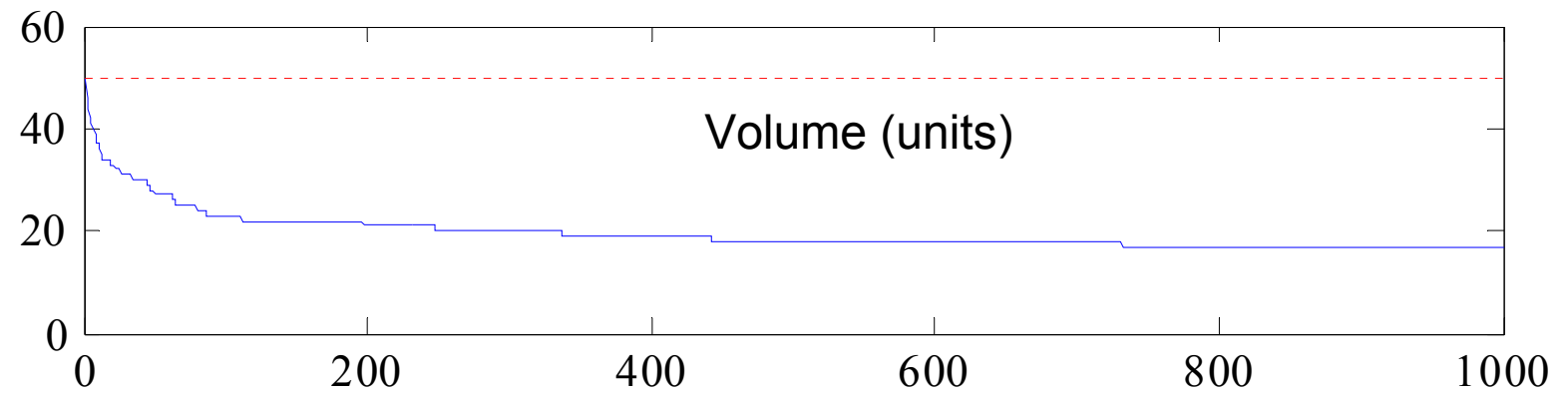
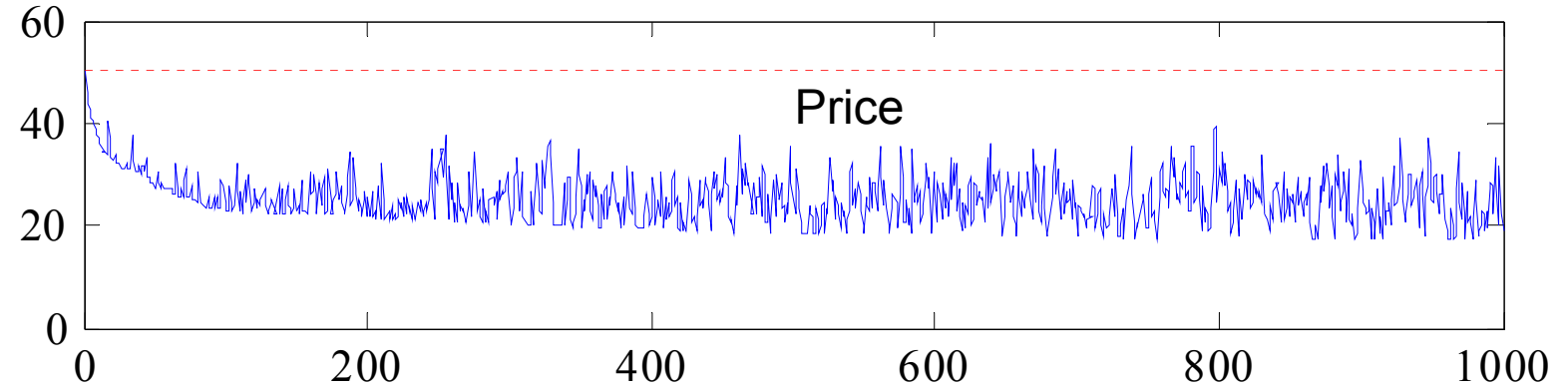
Market Results



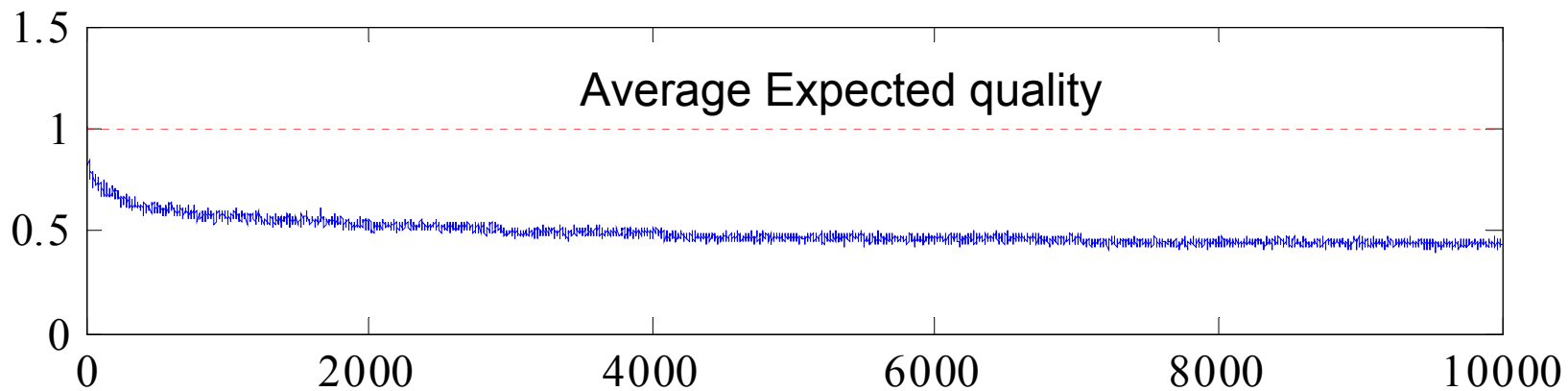
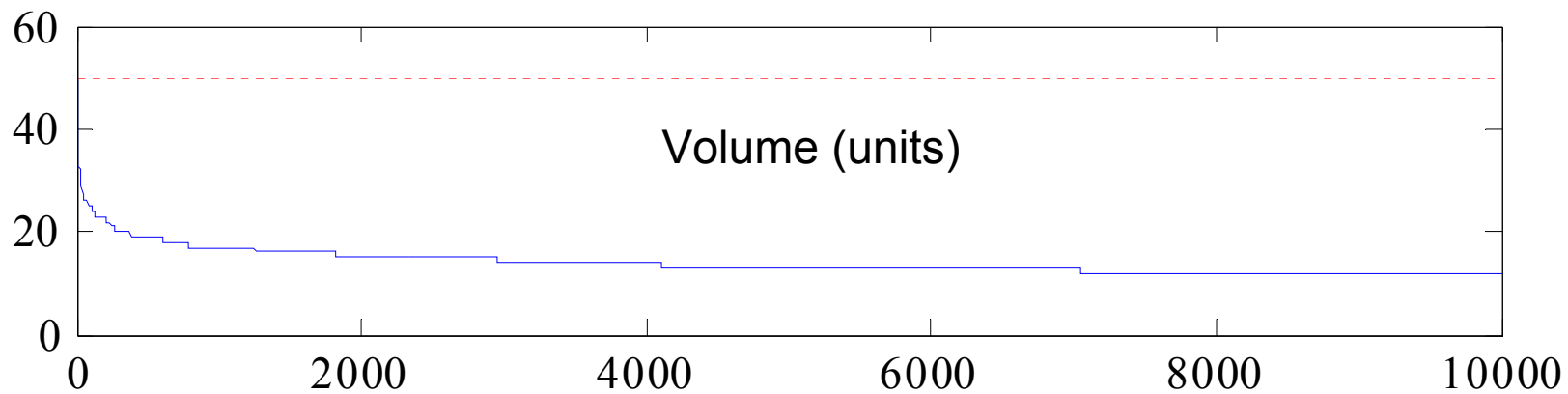
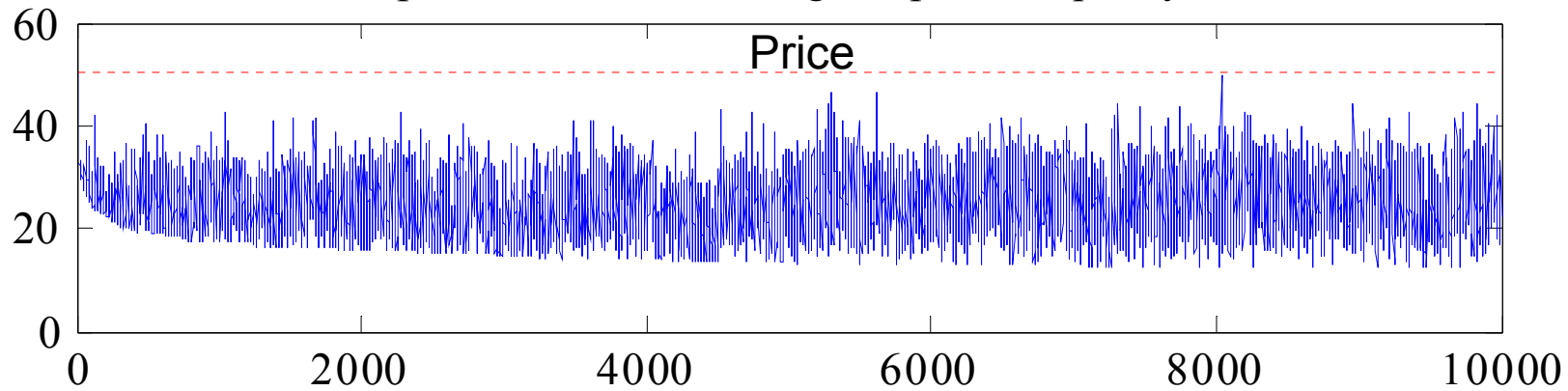
Market Results



price, volume, Average expected quality



price, volume, Average expected quality



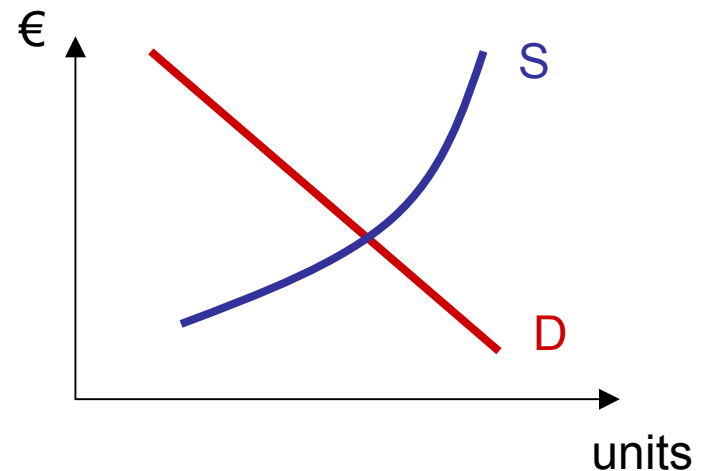
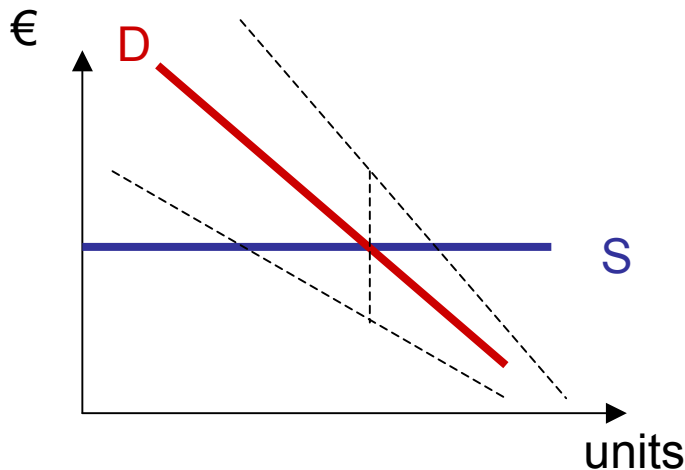
Analysis. Proposition I

I Assuming:

- A static supply,
- Any quality learning rule such that, if a product is not purchased, a buyer does not change her expected quality

Then:

The number of traded units must be monotonous decreasing

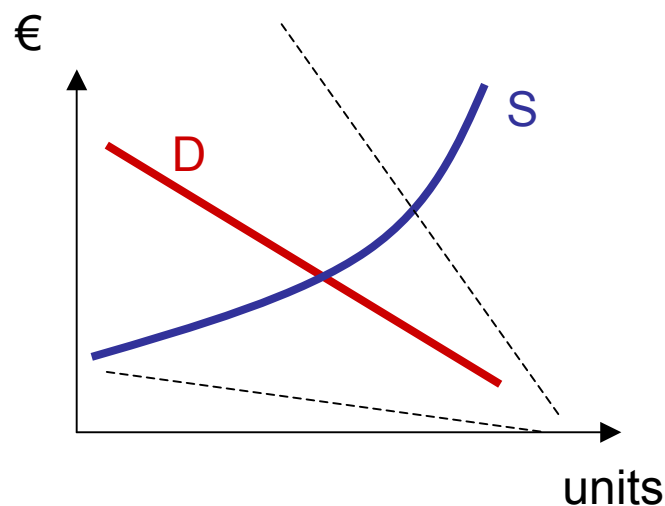
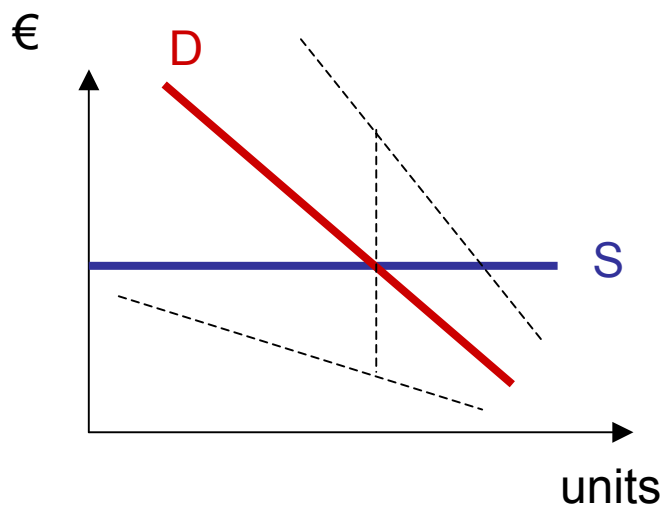


Analysis. Proposition II

II Assuming:

- *A static supply,*
- *Any quality learning rule such that, if a product is not purchased, a buyer does not change her expected quality*
- Quality variability is such that, by purchasing a series of “bad” items, any buyer might finally decide not to buy the product

Then: The market will eventually collapse



1 Introduction

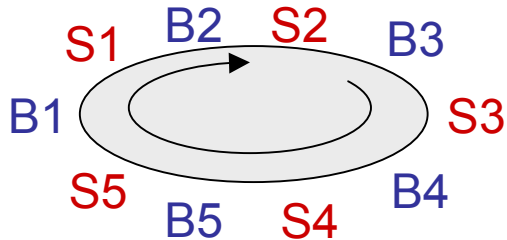
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A double auction market mechanism (I)

- Sequential offers for an item, centrally kept, until there is a match, and then for the next item

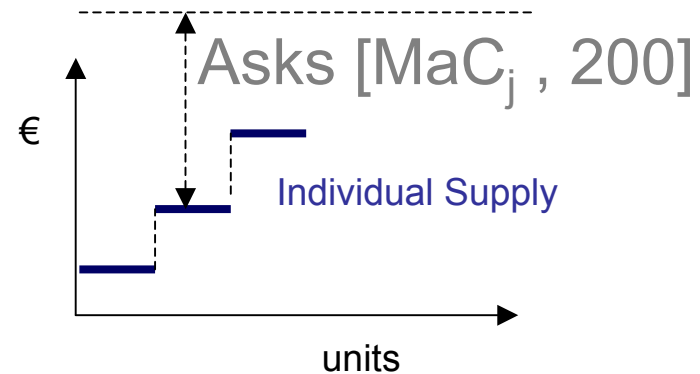


Highest Bid

Lowest Ask

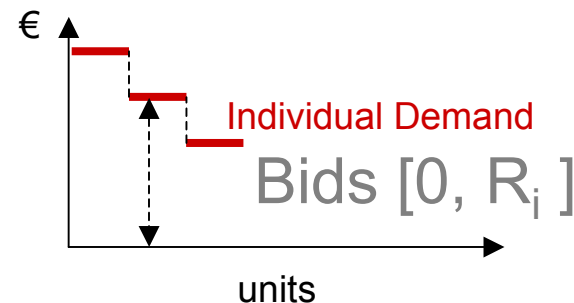
- 5 sellers ZI-C

$$\text{MaC}_j = 1 + 5n_j$$



- 5 buyers ZI-C

$$R_i = \widehat{Q}_i^{ni} (200 - 5n_i)$$



A double auction market mechanism

- Along an auction, every buyer updates her estimated quality after purchasing a new product

$$\hat{Q}_i^{ni+1} = (1 - \lambda) \hat{Q}_i^{ni} + \lambda Q_i^{ni}$$

Reference situation (no quality variability):

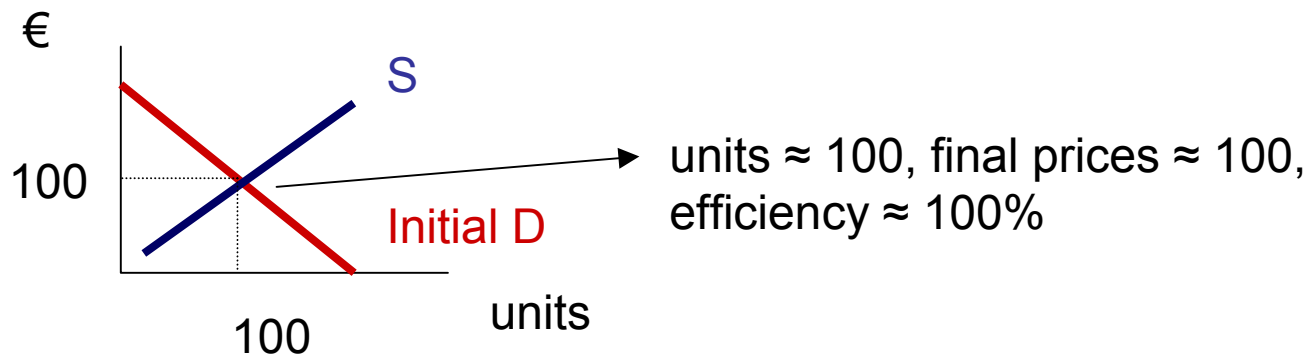


Table 1. Results of several auctions, without quality variability

	Auction number						
	1	2	3	4	5	5-105 Average	105-305 Average
Final price	102.8	99.3	102.1	104.1	96.8	100.7	100.4
Units	100	98	98	101	97	99.6	99.7
Efficiency	100%	99.8%	99.8%	100%	99.6%	99.8%	99.8%

Table 1. Results of several auctions, without quality variability

	Auction number						
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Final price	102.8	99.3	102.1	104.1	96.8	100.7	100.4
Units	100	98	98	101	97	99.6	99.7
Efficiency	100%	99.8%	99.8%	100%	99.6%	99.8%	99.8%

Table 2. Results of several auctions, with quality variability $q \sim U[0,2]$ and learning ($\lambda = 0.5$)

	Auction number						
	1	2	3	4	5	5-105 Average	105-305 Average
Final price	73.9	87.7	88.7	83.6	68.6	83.3	84.2
Units	78	82	88	88	72	79.8	80.8
Efficiency	77.5%	87.2%	99.4%	92.5%	78.3%	90.5%	91.4%

Table 1. Estimated quality after closing. Results of several auctions with quality variability $q \sim U[0,2]$ and learning ($\lambda = 0.5$)

	Auction number					
Buyer number	1	2	3	4	5	1-100 Average
1	0.41	0.82	0.30	0.95	0.46	0.59
2	0.78	0.63	0.59	0.33	0.87	0.58
3	0.71	0.40	0.29	0.60	0.37	0.53
4	1.50	0.75	0.55	0.35	0.52	0.62
5	0.80	1.06	0.43	0.55	0.35	0.58
Average	0.84	0.73	0.43	0.56	0.51	0.58

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Conclusions

When there is quality variability, some well-known aggregate phenomena, like the failure of some markets (used cars) and the success of some management policies (warranties), have classically been explained based on adverse selection (sellers' side).

Our model, based on buyers' behaviour with individual quality learning, provides an alternatively / complementary explanation for these market failures.

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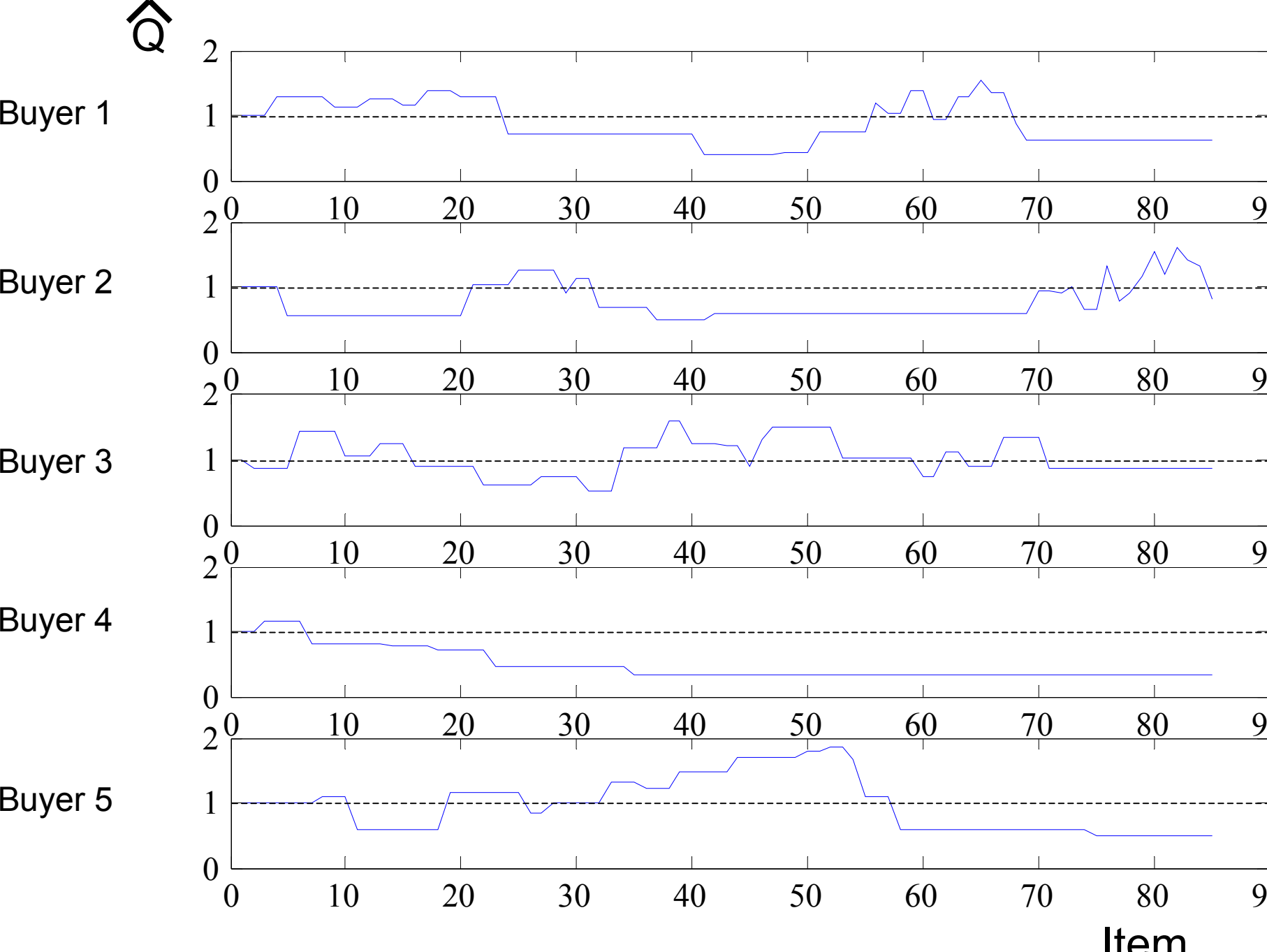
Cesáreo Hernández

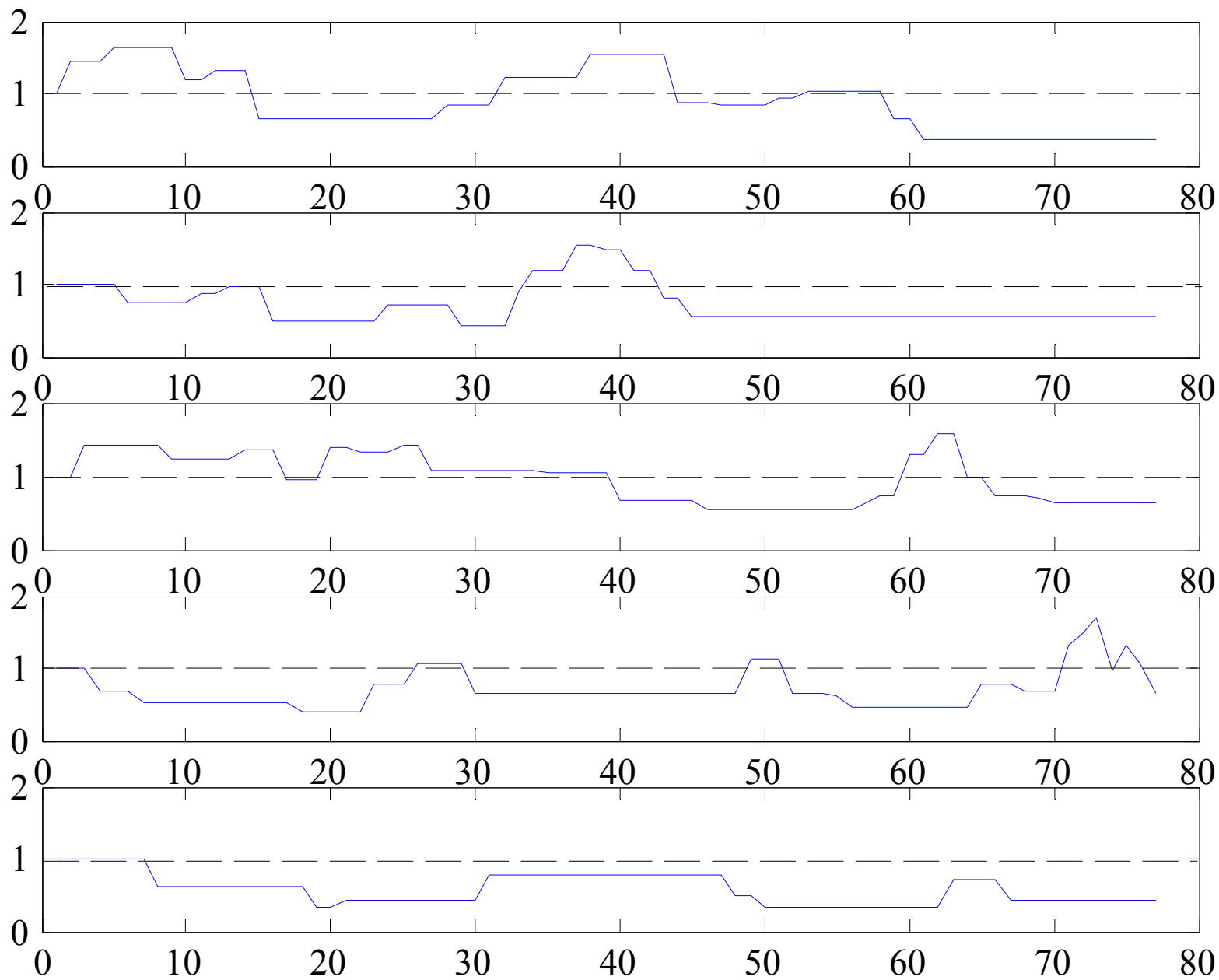
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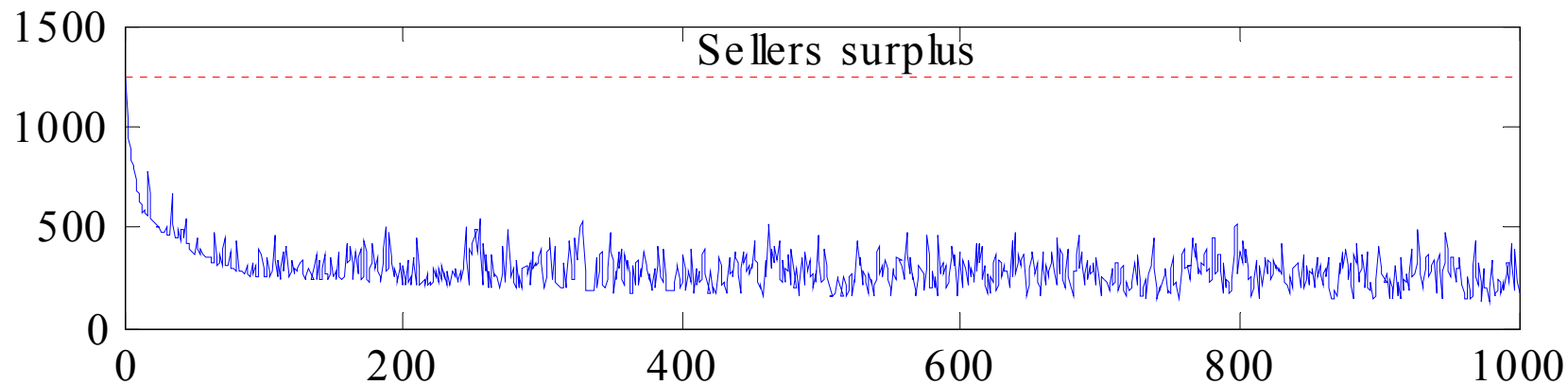
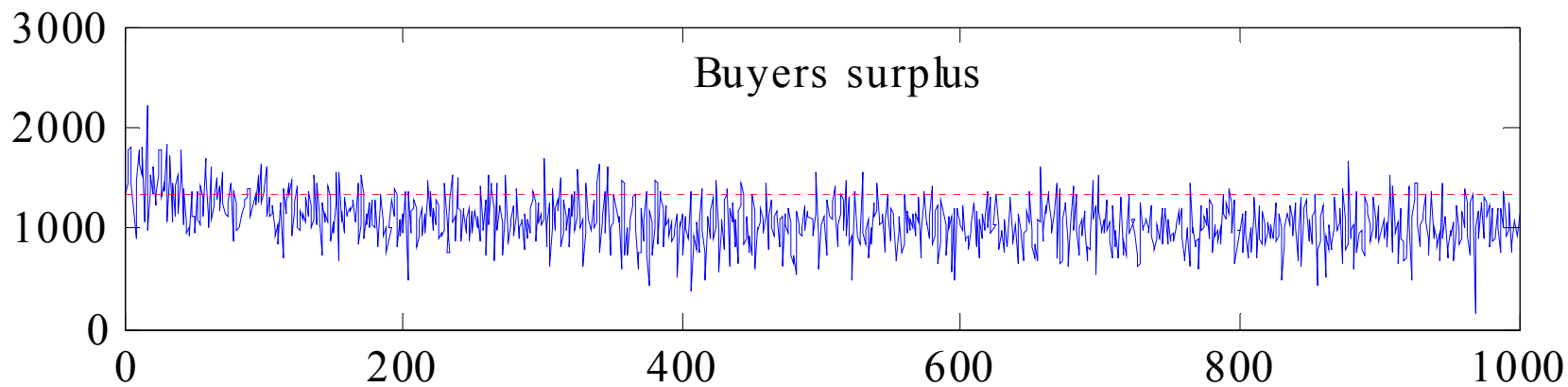
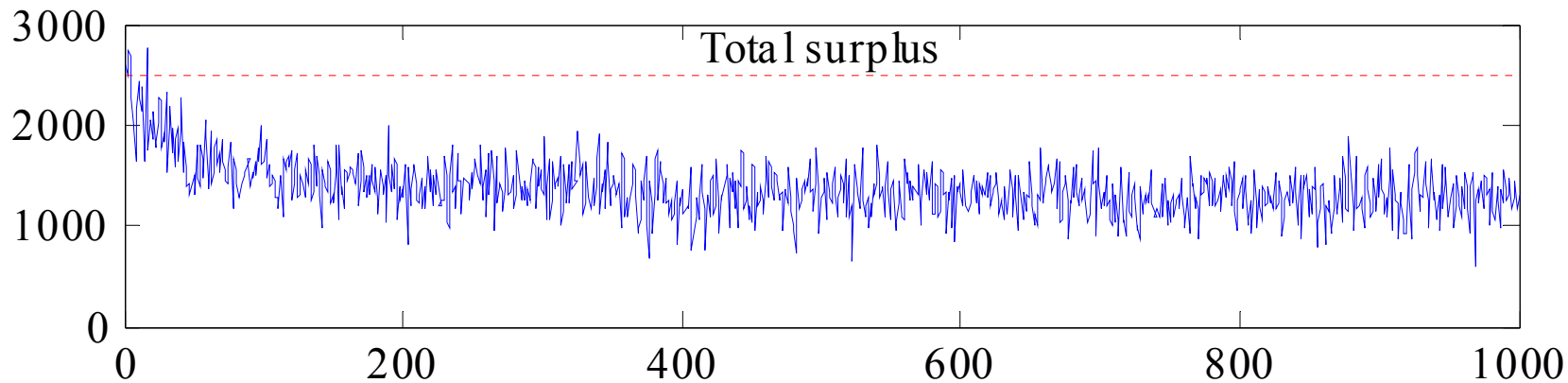
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