

Zero Knowledge Traders

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- Zero Knowledge Firm

How to find prices today?

- ▶ *Tatonnement*

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- ▶ Bilateral trading

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 - Gintis' evolution

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 - Zero Intelligence Plus

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Have agents, will trade

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I'd like to code a trading behavior for agents that is:

- ▶ Simple

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I'd like to code a trading behavior for agents that is:

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- ▶ Adaptive

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I'd like to code a trading behavior for agents that is:

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- ▶ General Purpose

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- ▶ Price-Maker

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I'd like to code a trading behavior for agents that is:

- ▶ Simple
- ▶ Adaptive
- ▶ General Purpose
- ▶ Price-Maker
- ▶ And not just for trading

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What is a seller supposed to do?

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 - No knowledge of the model

What is a seller supposed to do?

- ▶ Imagine a seller
- ▶ Assume target (sell 100 units each day)
- ▶ Seller has zero knowledge:
 - No knowledge what the demand looks like
 - No knowledge who the competition is
 - No knowledge of the model
- ▶ All the seller can do is set its sale price.

Zero Knowledge seller

- ▶ The seller sets a price and see how much it sells.

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- ▶ When below target it decreases its price (and viceversa)

Zero Knowledge seller

- ▶ The seller sets a price and see how much it sells.
- ▶ When below target it decreases its price (and viceversa)
- ▶ Adapts periodically.

Sellers and PID

- ▶ Given distance from target

$$e = y^* - y$$

Chooses the value of the price p

Sellers and PID

- ▶ Given distance from target

$$e = y^* - y$$

Chooses the value of the price p

- ▶ Updates through a simple PID controller

$$p_t = ae_t + b \int_0^t e_\tau d\tau + c \frac{de_t}{dt}$$

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PID Controllers: why using them?

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- ▶ Feed-Forwarding

PID Controllers: why using them?

- ▶ PID Controllers use no information.
- ▶ PID Controllers assume no model knowledge.
- ▶ Feed-Forwarding
- ▶ Easily split targeting and maximizing.

PID Controllers: Drawbacks

- ▶ 3+1 parameters per controller

PID Controllers: Drawbacks

- ▶ 3+1 parameters per controller
 - Draw from a generating distribution
 - Endogenize through evolution
 - Auto-tune

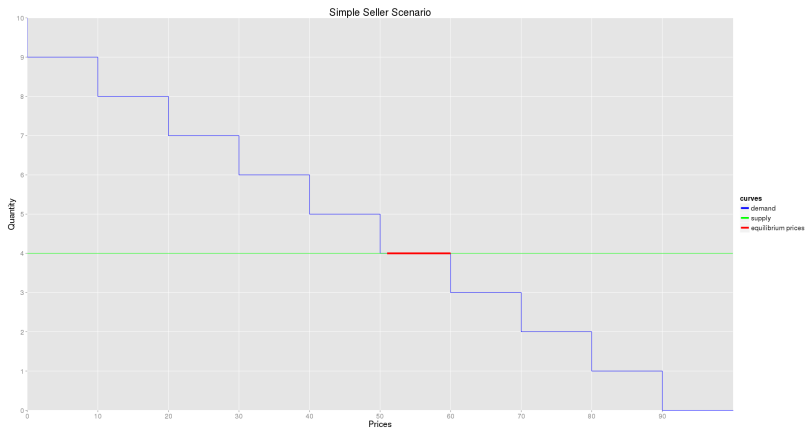
PID Controllers: Drawbacks

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PID Controllers: Drawbacks

- ▶ 3+1 parameters per controller
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 - Auto-tune
- ▶ Lumpy World
- ▶ Windup and saturation

A seller test



Sample Run 1



Figure : A sample run with the PID controller finding the right price

Sample Run 2

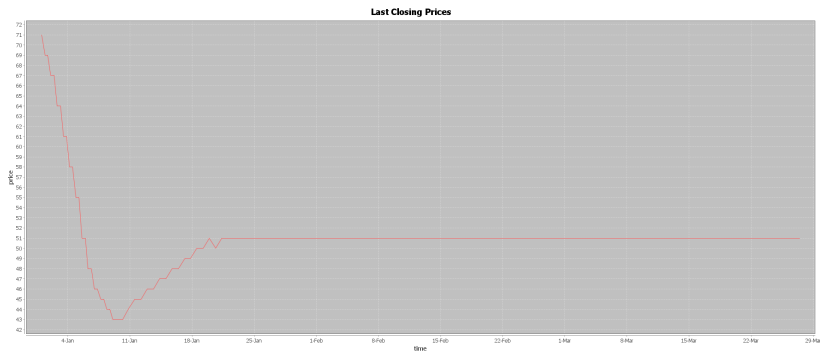
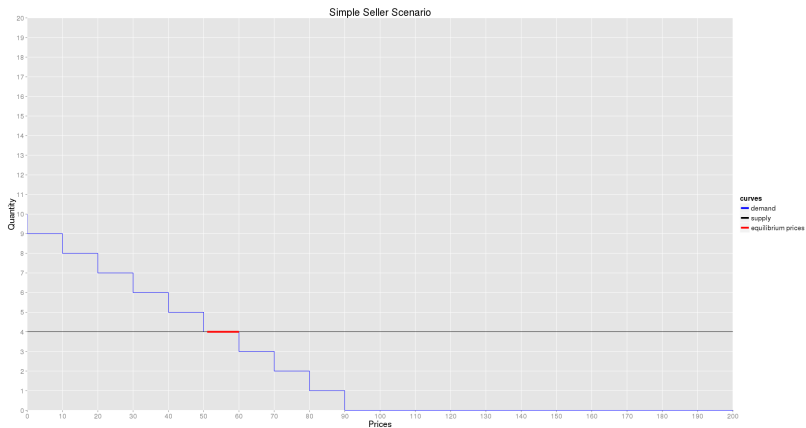
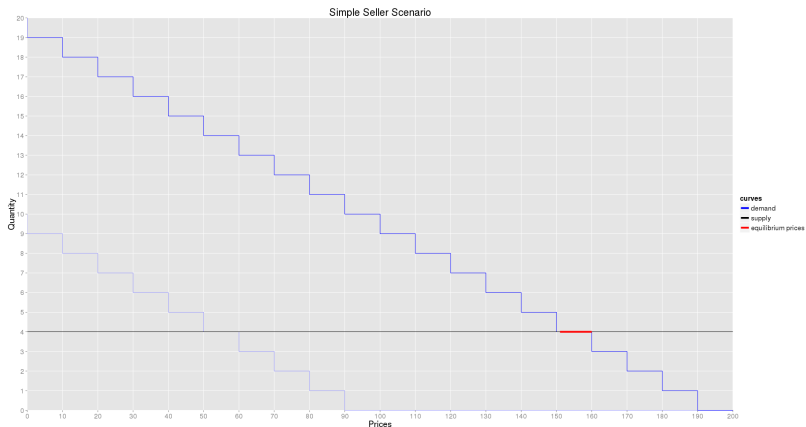


Figure : Another sample run, with inventory driven undershoot

A twist



A twist



Tinkering over Learning

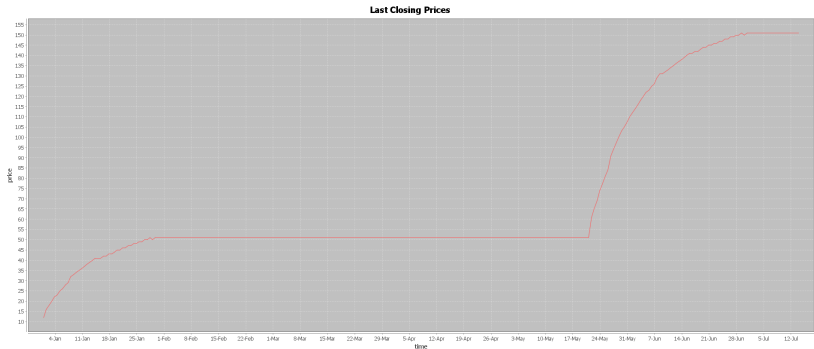


Figure : The seller adapts, without being told

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Where do targets come from?

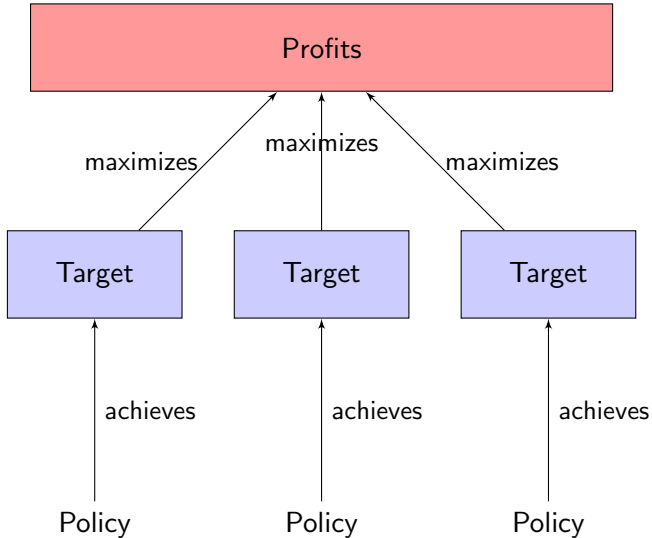
- ▶ Trading is nice, but producing and trading is better

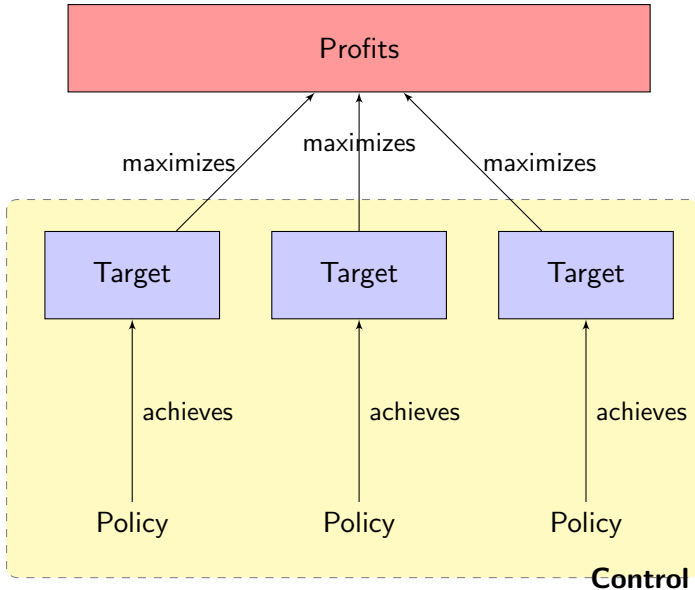
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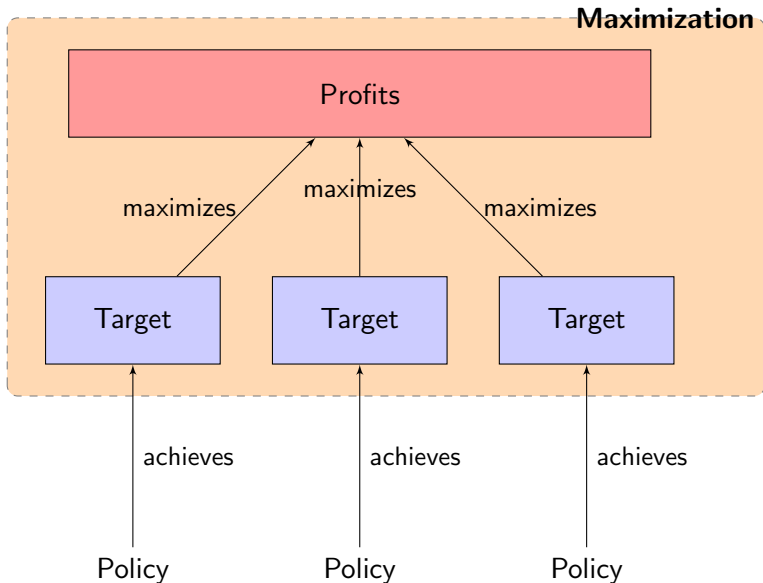
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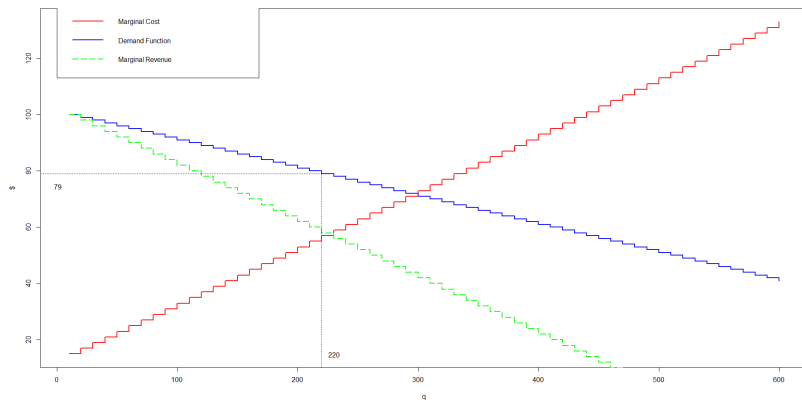
- ▶ Trading is nice, but producing and trading is better
- ▶ A full theory of a firm.
- ▶ Tinkering, independent units.







Monopolist



In the model

- ▶ Add one firm, with a single plant and a sales department.

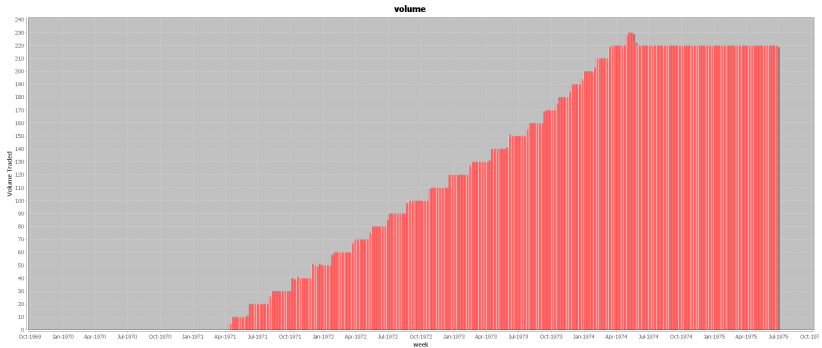
In the model

- ▶ Add one firm, with a single plant and a sales department.
- ▶ The firm has absolutely no knowledge of the world

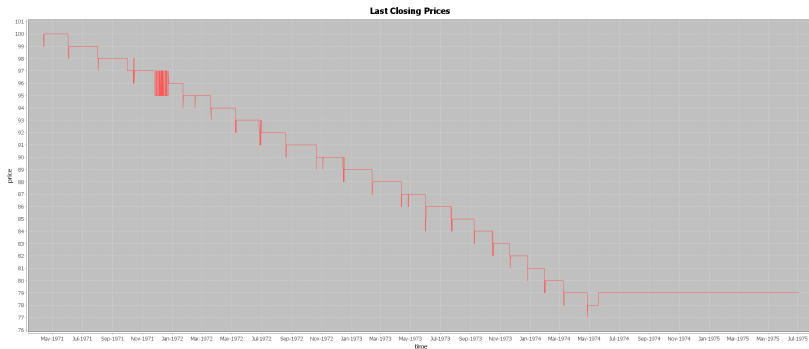
In the model

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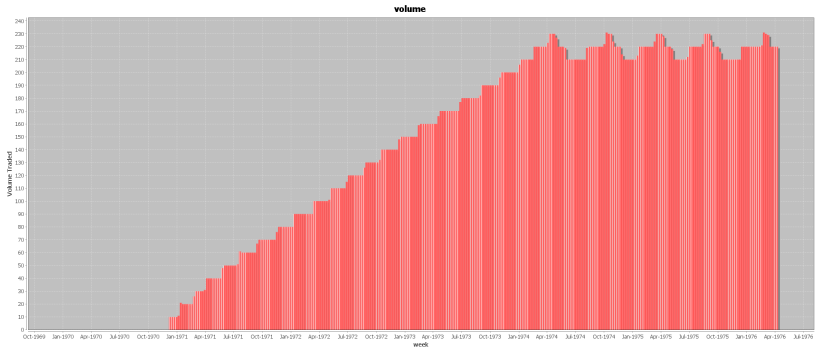
Model Monopolist



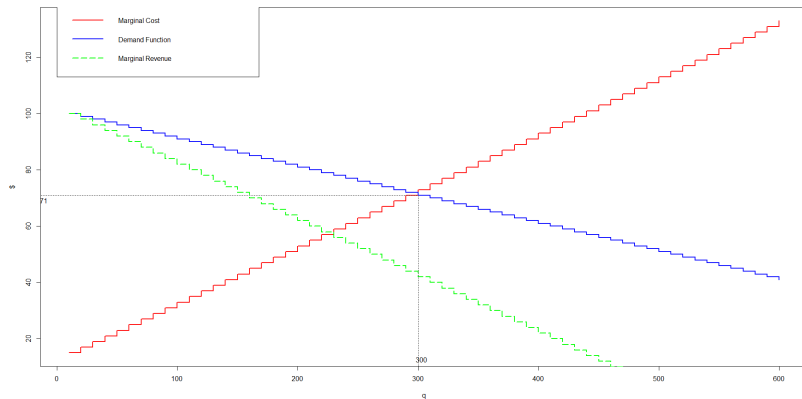
Model Monopolist



Model Monopolist, different hill-climber



Competitive



In the model

- ▶ Just as before, but now 5 firms

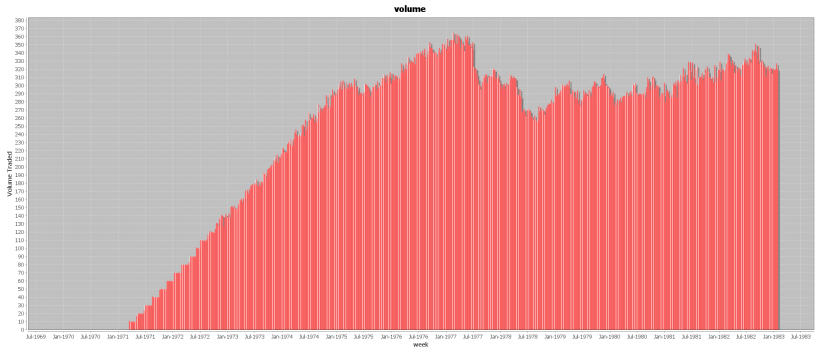
In the model

- ▶ Just as before, but now 5 firms
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Model Competition, volume



Model Competition, price

