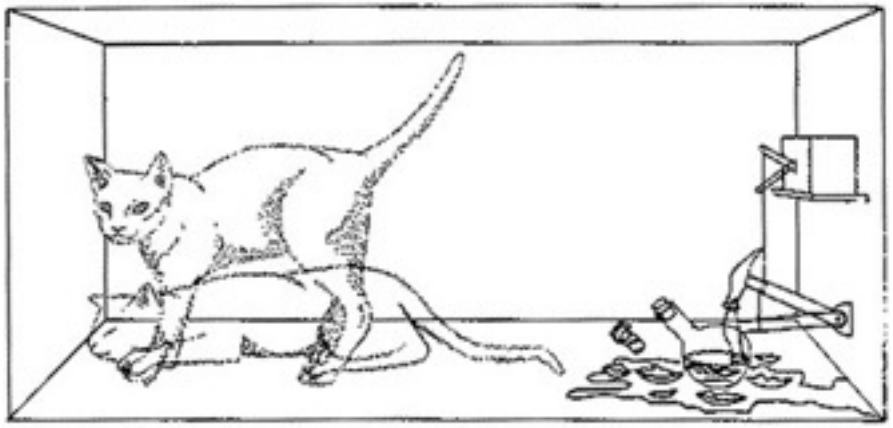
# Modul IV:
# Stokastiska modeller

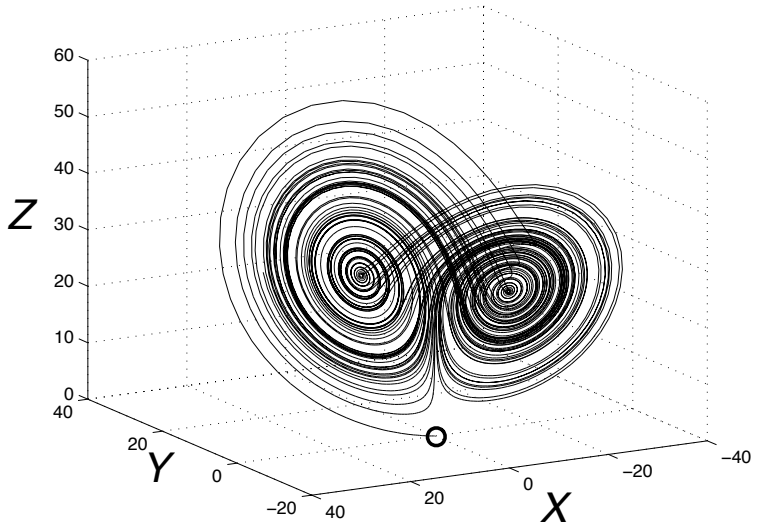
# Innehåll

- Intro/Motivering
- Stokastiska processer
  - Exempel
- Markovkedjor:
  - diskret tid
  - kontinuerlig tid

# Finns slump?

- Ja, på kvantnivå
- Ja, i system med deterministiskt kaos



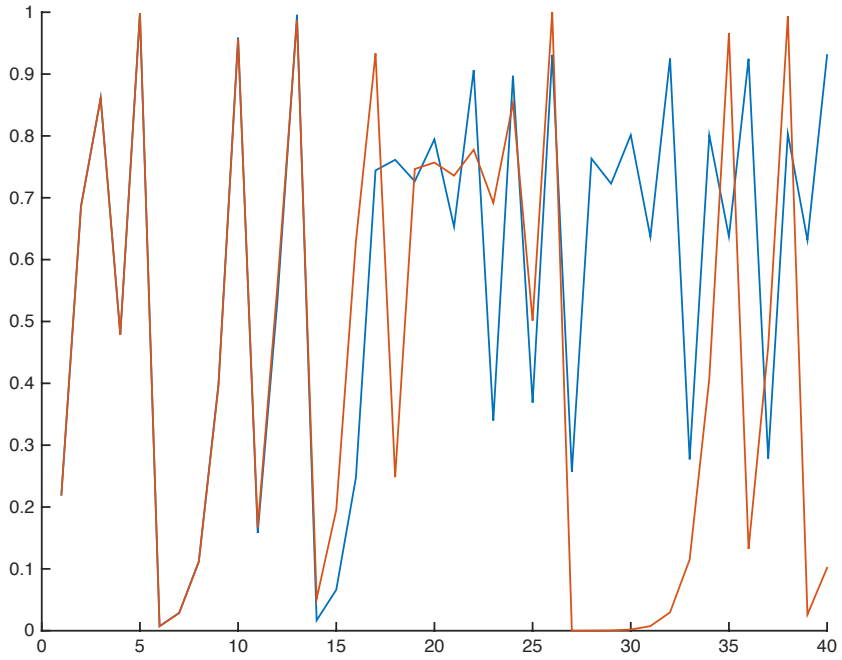


# Logistiska avbildningen

$$x_{n+1} = r x_n (1 - x_n)$$

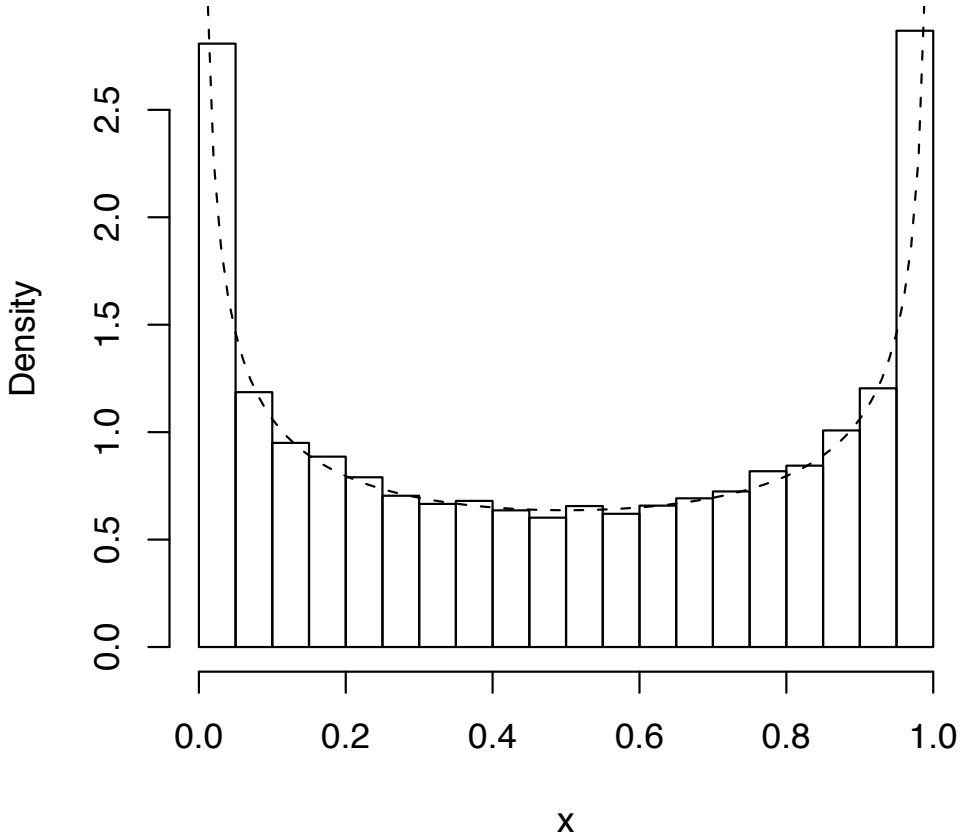
- Givet $x_0$ förutsäg $x_{40}$

$x_0$ skiljer sig på 5:e decimalen



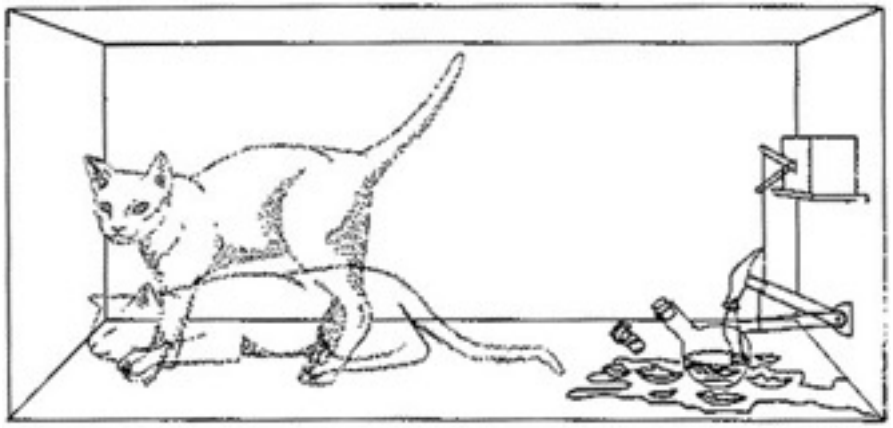
# Invariant måtT

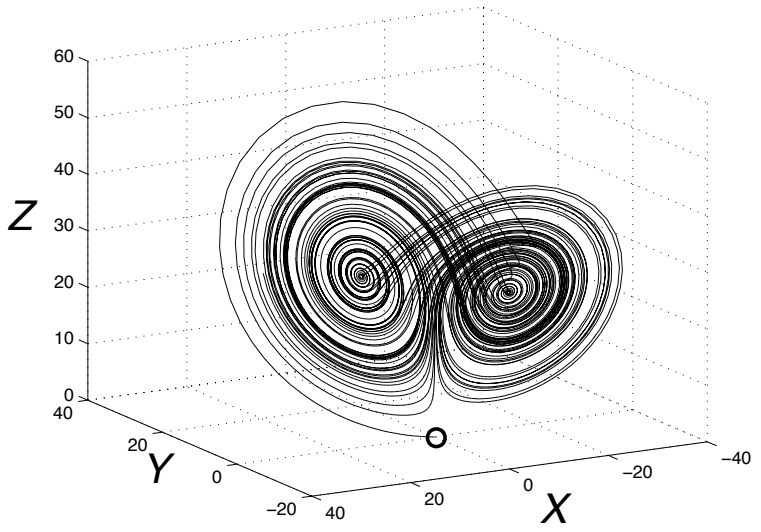
$$\rho(x) = \frac{1}{\pi x \sqrt{1-x}}$$



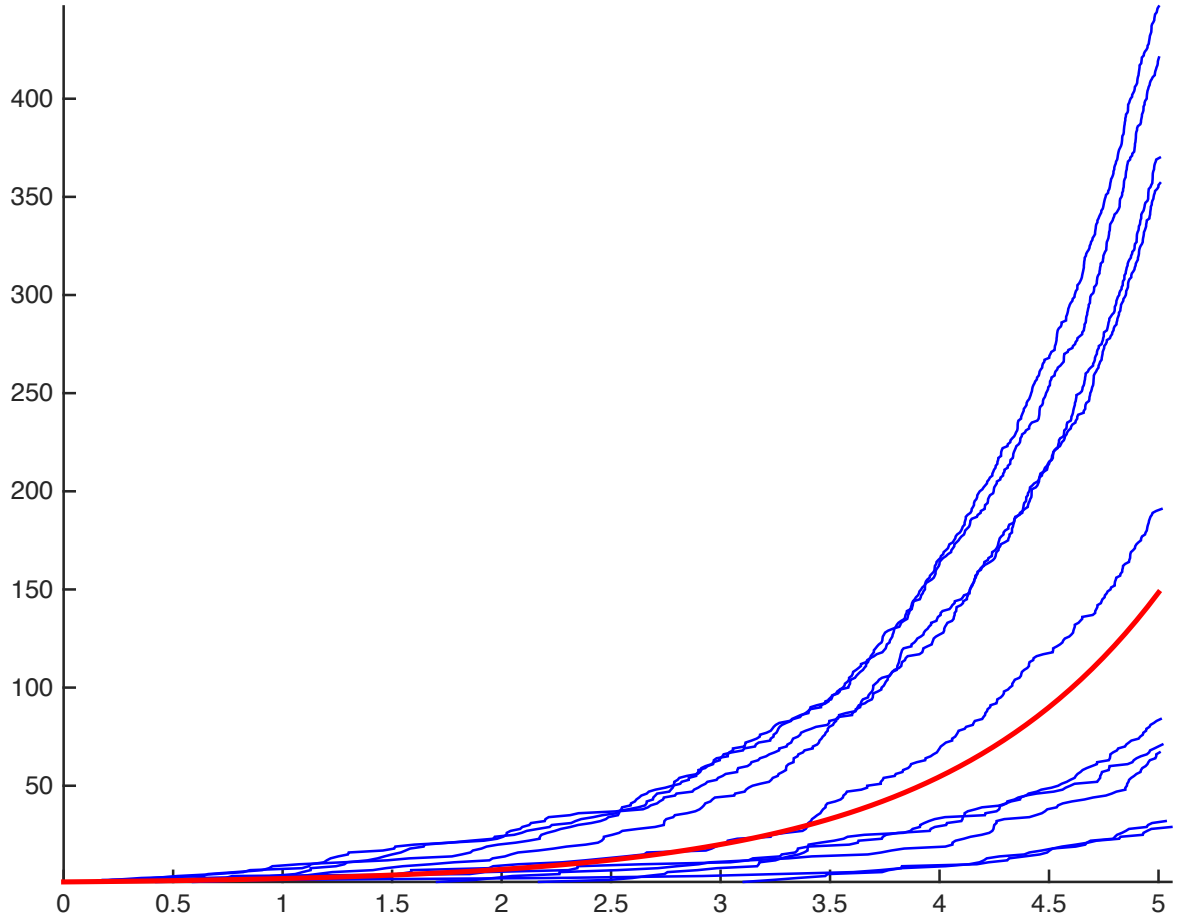
# Finns slump?

- Ja, på kvantnivå
- Ja, i system med deterministiskt kaos
- I system med många komponenter där vi saknar fullständig kunskap verkar det så

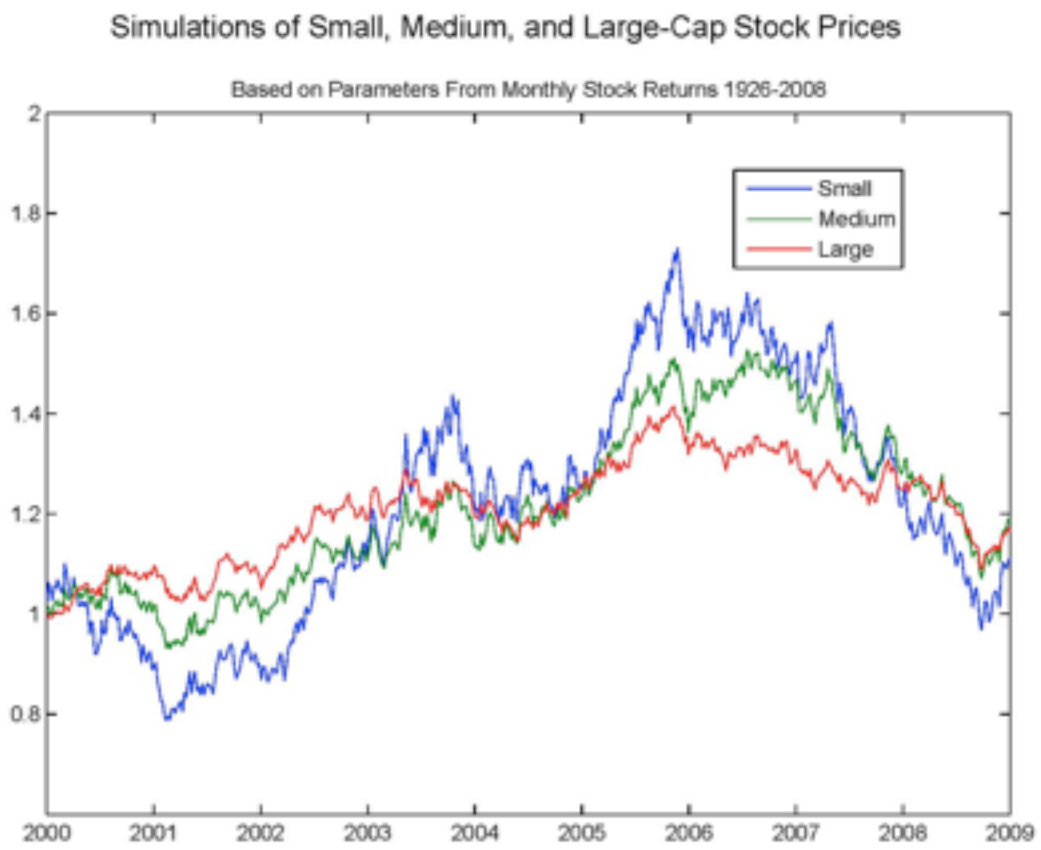




# Populationsdynamik



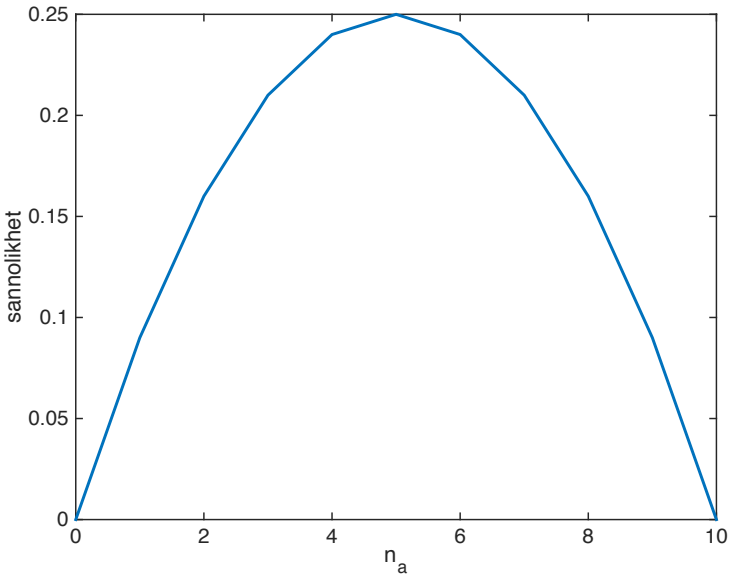
# Aktiepriser

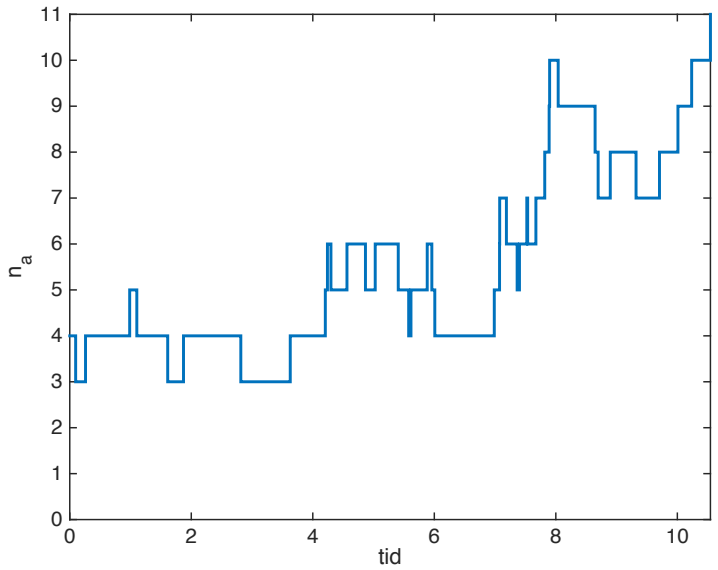


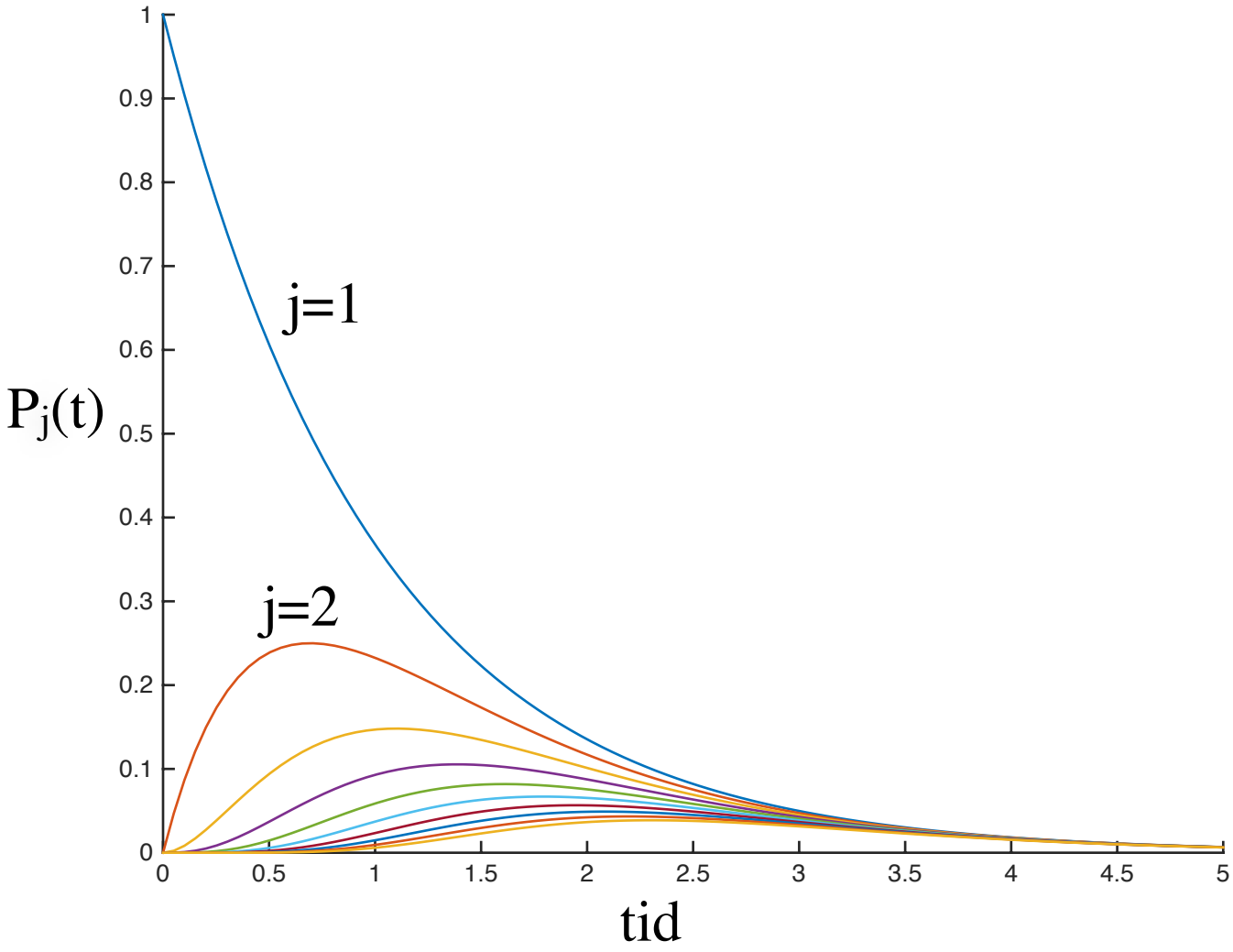

$$\frac{dS}{S} = \mu\,dt + \sigma\,dW$$

$$\frac{\partial V}{\partial t} + \frac{1}{2}\sigma^2 S^2 \frac{\partial^2 V}{\partial S^2} = rV - rS\frac{\partial V}{\partial S}$$

# Moranprocessen




$P_j(t)$
j=1
j=2
tid
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5