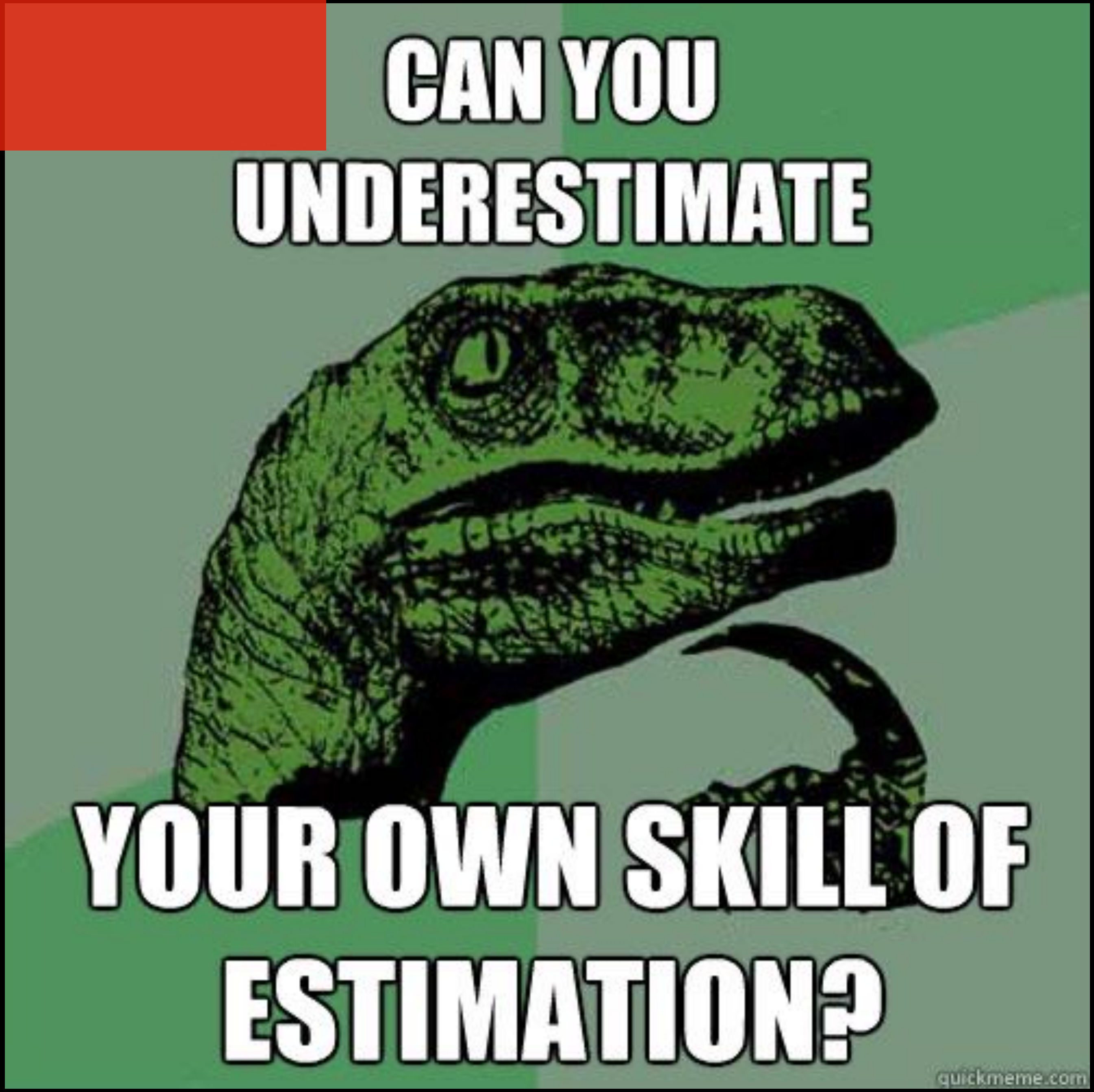
Estimation


CAN YOU
UNDERESTIMATE
YOUR OWN SKILL OF
ESTIMATION?
quickmeme.com

Learning outcomes

How to choose the **right data** for estimation
Implications of **ergodicity** on estimation
Use the **method of simulated moments**

Calibration vs estimation

Calibration: minimise the difference between **R** and **M**
Estimation: find the true values of the variables

Calibration vs estimation

Real world output

Calibration: minimise the difference between **R** and **M**

Estimation: find the true values of the variables

Model output

Comparing apples with apples

How do we compare the **model-produced data** with the r**eal-world-produced data**?

Comparing apples with apples

How do we compare the **model-produced data** with the r**eal-world-produced data**?

Look for equilibria!

The importance of ergodicity

Our model generates y_t, which becomes stationary with mean $\mu^* = r\theta$

Say the model is non-ergodic, so μ^* changes at every run, for the same θ

The importance of ergodicity

Our model generates y_t, which

be

μ^*

We need to understand the properties of the model and of the data before the estimation phase

say

changes at every run, for the same θ

Preliminary tests

Stationarity is easy to test but things can be tricky if the data is not stationary

Ergodicity cannot be tested unless we observe many realisations of the same process

Example

JVC - vhs

Sony - betamax

Conclusion

If we, somehow, get to be fairly positive about the ergodicity of the system, then we can use that for estimation.

Otherwise there are other methods to deal with estimation (just wait a few slides)

Simulated minimum distance

We want to minimise the distance between the summary statistics of the real-world system and those of our model

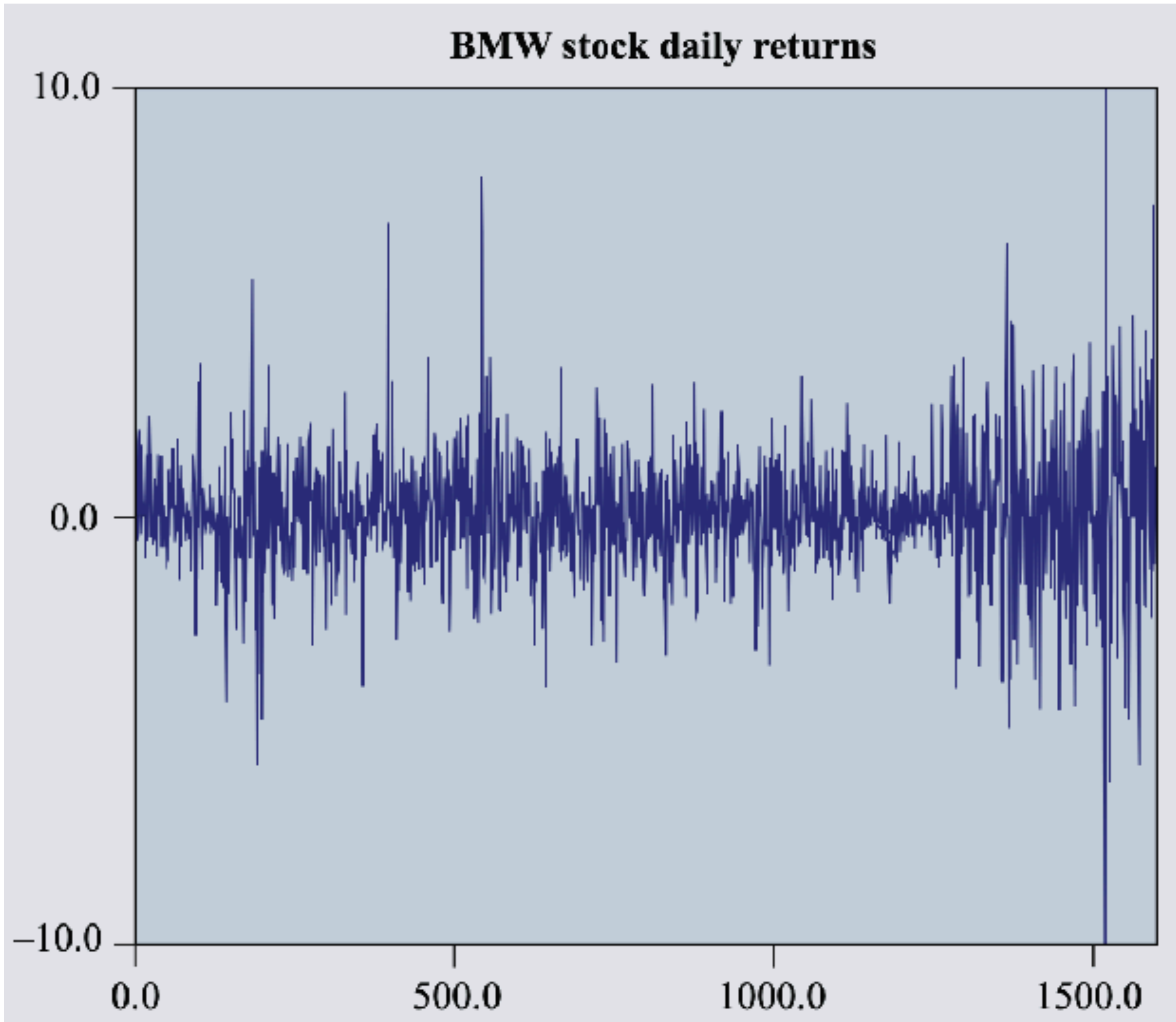
We can use the method of simulated moments

Method of simulated moments

$$\hat{\theta} = argmin_{\theta}[\mu*(\theta) - \mu_R]'W^{-1}[\mu*(\theta) - \mu_R]$$

Weights

Back to finance



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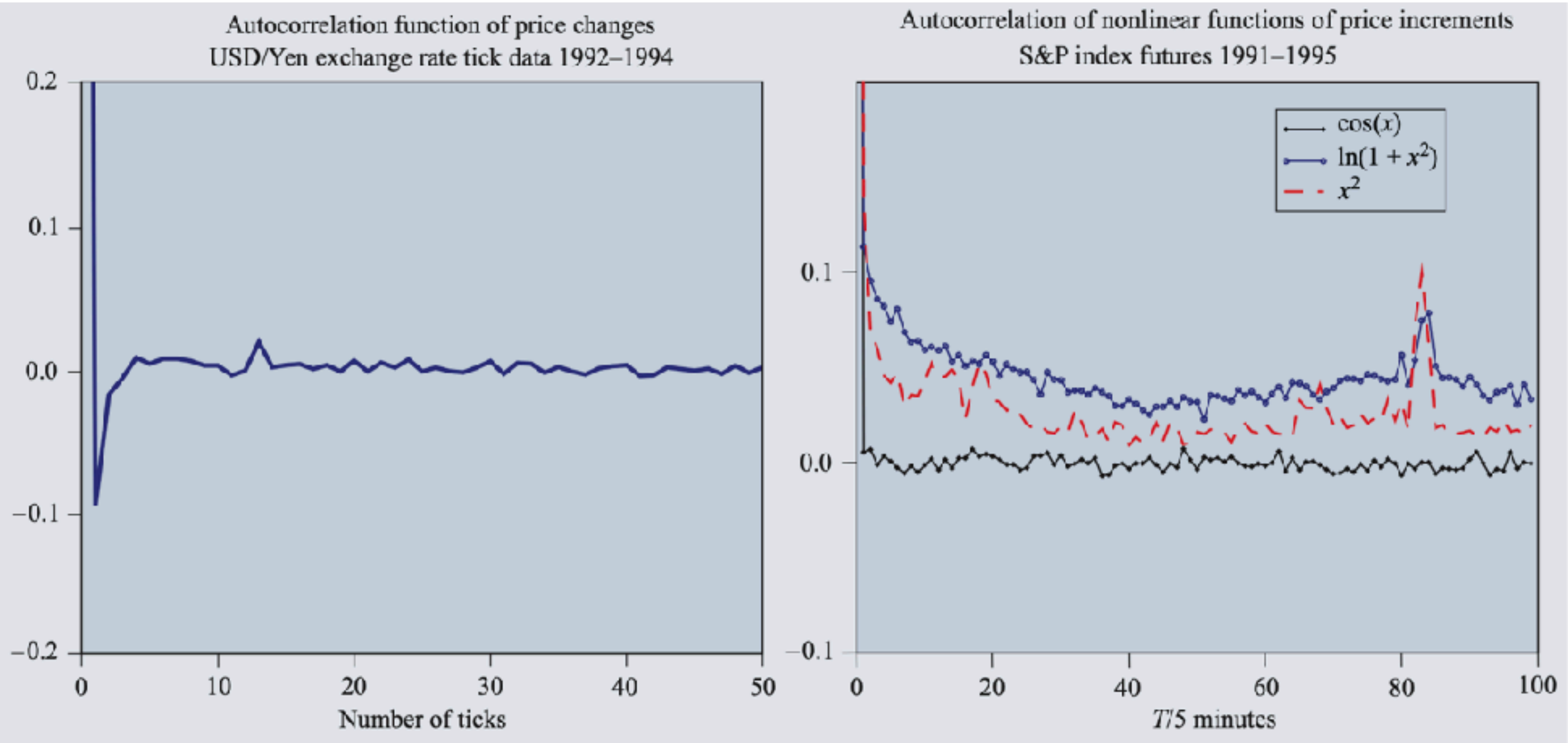

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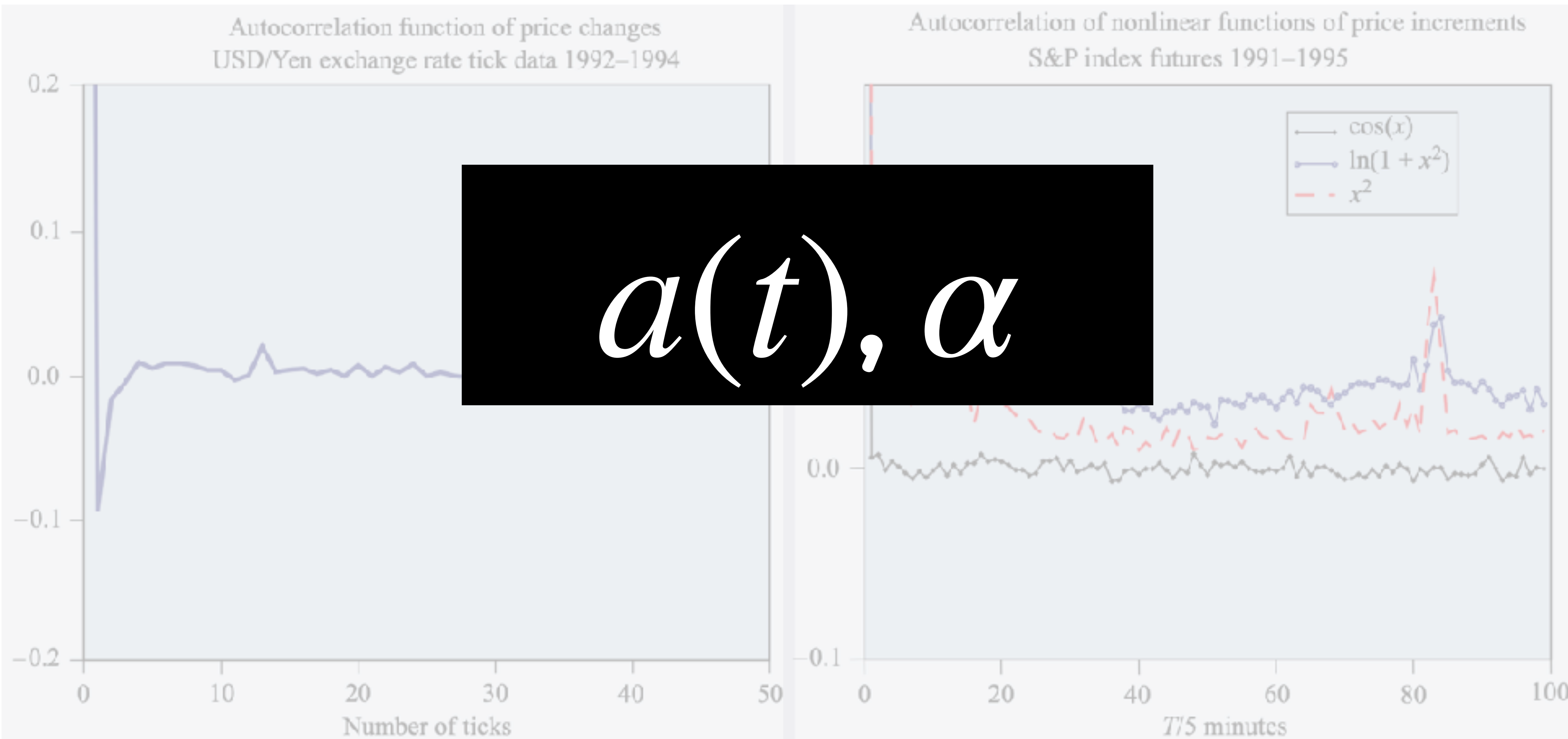

$$a(t), \alpha$$

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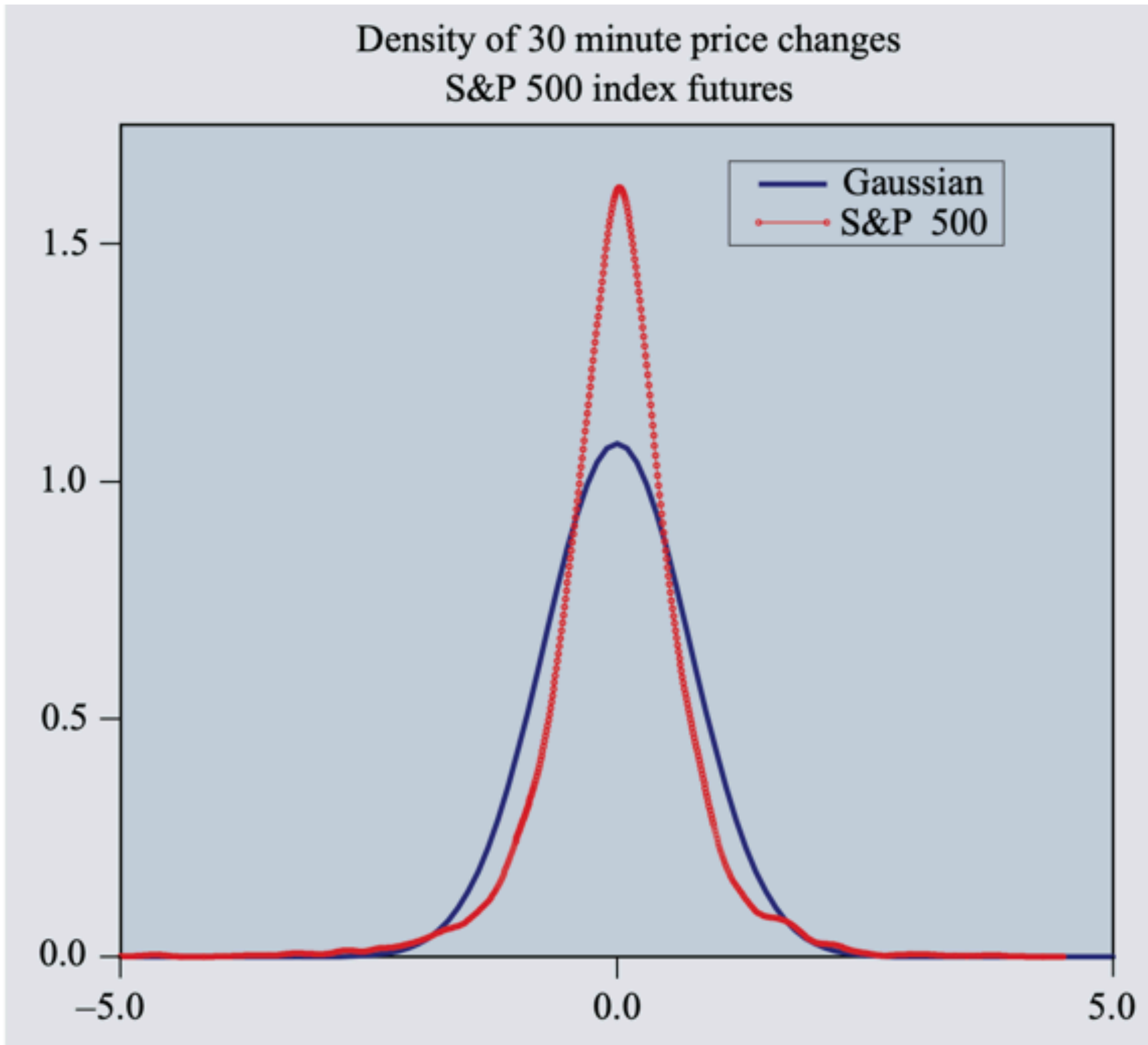

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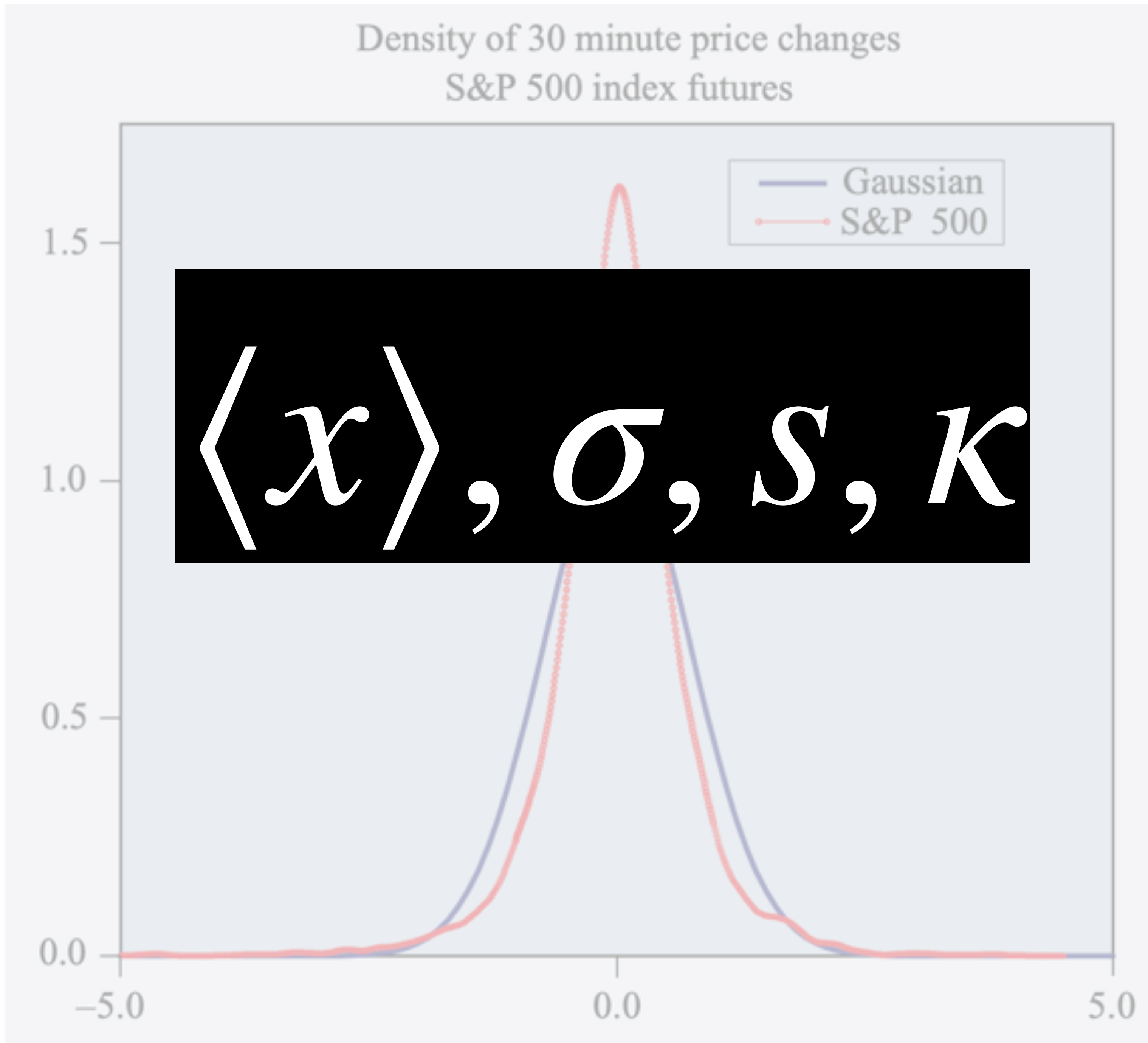

$$\langle x \rangle, \sigma, s, \kappa$$

Method of simulated moments

$$\hat{\theta} = argmin_{\theta}[w_1(\hat{\kappa} - \kappa) + w_2(\hat{a}(0) - a(0)) + w_3(\hat{x} - \langle x \rangle)]$$

Method of simulated moments

$$\hat{\theta} = argmin_{\theta}[w_1(\hat{\kappa} - \kappa) + w_2(\hat{a}(0) - a(0)) + w_3(\hat{x} - \langle x \rangle)]$$

$$\hat{\theta} = argmin_{\theta}[w_1(\hat{\kappa} - \kappa) + w_2(\hat{\lambda}_a - \lambda_a) + w_3(\hat{x} - \langle x \rangle)]$$

Bayesian estimation

More appropriate when:
- inference is needed
- there are prior and posterior distributions

Tesco example - Recap

One type of agents with heterogeneous variables

Variables: shopping habits, expenditure, bias on deals, etc.

Actions: buy (last year people also suggested "steal")

Interactions: recommend products to others, interact with store

How would you use the data?

What summary statistics would you use for estimation/calibration?

How to build abms cheat sheet

Nature of agents
List of variables describing their state
List of actions the agents can perform
Structure of their interaction with other agents

} **Agent design**

Definition of output variables of interest
Appropriate experimental design
Analysis of equilibria
Sensitivity analysis

} **Experiment**

How to build abms cheat sheet

Select the appropriate data
Input validation
Output validation

} **Validation**

Select the appropriate data
Test for stationarity and ergodicity
Methods of simulated distances

} **Estimation**

Congratulations!
Now you know how to build an agent-based model

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