

Ergodicity economics: lecture plan

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Tools

Lecture 1

Coin game. Random variable. Expectation value. Ensemble average.

Lecture 2

Stochastic process. Time average. Ergodicity.

Lecture 3

Random walk. Brownian motion. Stochastic differential equations.

Lecture 4

Geometric Brownian motion. Itô calculus.

Microeconomics

Lecture 5

Decisions in a riskless world. Growth rates (additive, multiplicative, general).

Lecture 6

Decisions in a riskless world. Discounting, preference reversal, impatience and poverty.

Lecture 7

Decisions in a risky world. Perturbed dynamics (additive, multiplicative, general), growth rate is ergodic. EE decision model.

Lecture 8

Decisions in a risky world. Gambles (random number and duration) as pieces of stochastic processes, expected wealth and expected utility, ergodicity transformation and corresponding wealth process – Ito.

Lecture 9

Decisions in the real world. St. Petersburg paradox, Copenhagen experiment, insurance.

Lecture 10

Decisions in the real world (previous 2 lectures may not get finished).

Macroeconomics

Lecture 11

Lognormal distribution. Two growth rates. Measuring inequality. Condensation.

Lecture 12

Rescaled wealth. Dynamics and distributions. Jensen's inequality. Power laws.

Lecture 13

Sums of lognormals. Random energy model.

Lecture 14

Farmer's fable. Cooperation in GBM. Correlated fluctuations. Idiosyncratic parameters.

Lecture 15

Reallocating GBM. Model regimes. Inverse gamma distribution.

Lecture 16

Ergodic hypothesis. US wealth data.

Lecture 17

A two-asset market, portfolio theory: Markowitz, Sharpe ratio, expected return, growth rate optimization, optimal leverage.

Lecture 18

Stochastic market efficiency: efficiency, stability, predictions and accuracy.

Lecture 19

Stochastic market efficiency: a theory of noise, equity premium puzzle solution, central bank interest rates, fraud detection.

Lecture 20

Stochastic market efficiency: real markets. Backtests of constant-leverage investments, SP500, Dax, Bitcoin, Madoff; full time series and expanding windows, typicality.