ACE Financial Modeling

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- 0^{th} generation: SFI Artificial Stock Market
- 1^{st} generation: Lux and Lebaron
- 2^{nd} generation: NASDAQ model
- 3^{rd} generation: current work

Agent-Based Financial Markets: 0^{th} Generation

- SFI Artificial Stock Market:
  - Set-up:
    - 1 risky asset
    - 1 risk-free asset
    - Heterogeneous predictors of risky asset price
  - Qualitative empirical goals…
  - Interested in finding parameter values that 'docked' with reigning theoretical notions (e.g., 'rational expectations equilibria')

Facts Across Markets

- Non-Gaussian return distribution

$$\log\left(\frac{P_{t+1}}{P_t}\right)$$

- Heavy tailed-distribution of volume
- Excess volatility
- Clustered volatility
- No autocorrelation in returns
- Autocorrelation in absolute returns

Agent-Based Financial Markets: First Generation: Lux

- Lux [1998], Lux and Marchesi [1999]:
  - Two types of agents: fundamental and technical traders, *endogenously* determined
  - Result: During periods of high volatility, fundamental traders become technical traders
  - Successes: Heavy-tailed distribution of returns, clustered volatility
  - Weaknesses: Size of the population has to be 'tuned'—too many agents, fluctuations disappear

Agent-Based Financial Markets: First Generation: LeBaron

- LeBaron [2000, 2001, 2002]:
  - Agents are artificial neural networks
  - Agent 'type' parameterized by time horizon
  - Result: agents with long memory do less well than agents with short memory
  - Successes: reproduces heavy tails in returns distribution
  - Unsatisfactory: perfect market-clearing

Agent-Based Financial Markets: Second Generation

- NASDAQ simulation…
  - Rich in institutional detail
  - Evolutionary approach to agent specification
  - …

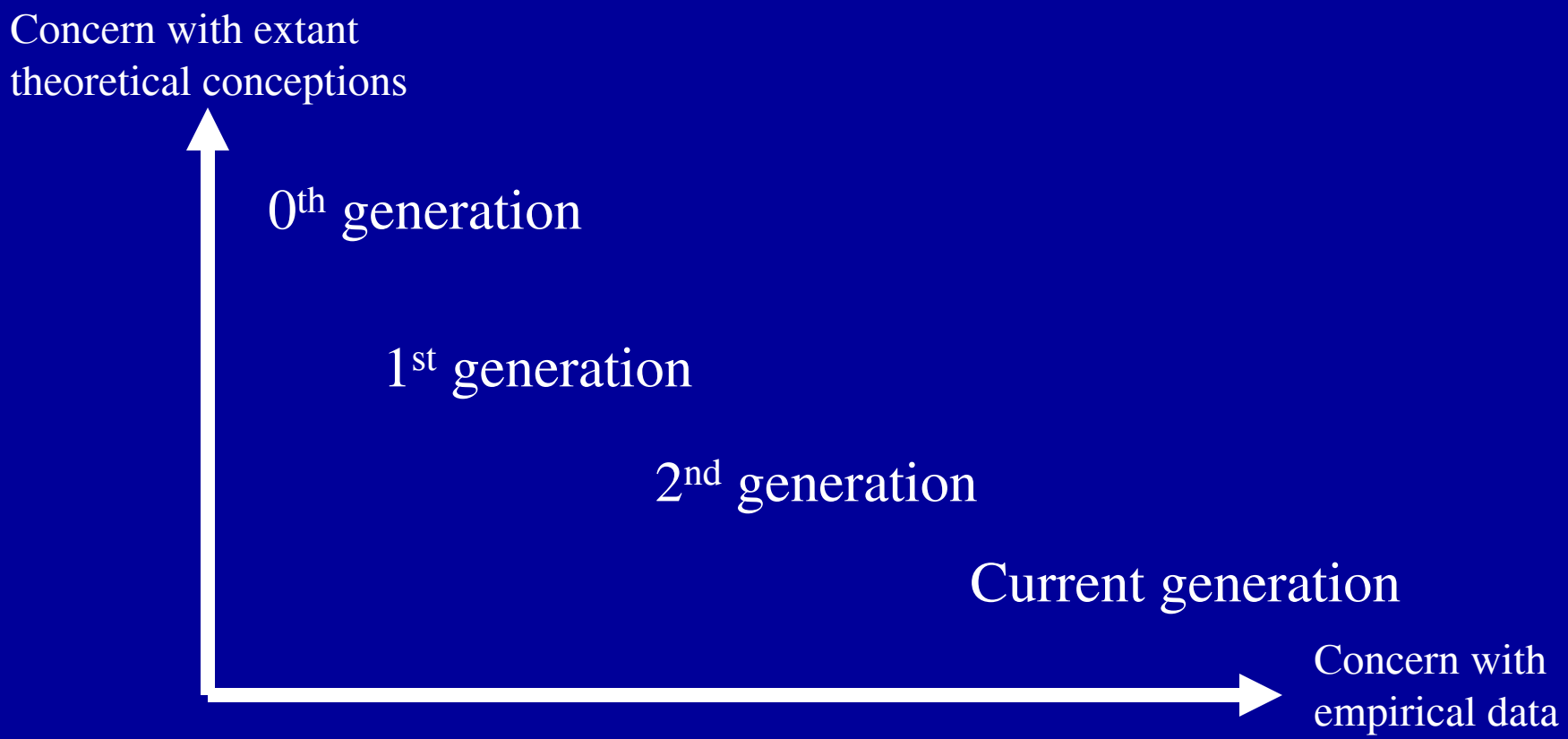
Agent-Based Financial Markets: Current Generation

- Given empirical regularities…
  - Heavy tails in return distributions
  - Excess volatility and clustered volatility
  - Autocorrelation in absolute returns
- Goal is to build agent models the reproduce all of these regularities *simultaneously*
- Rise of the econophysicists…

Agent-Based Financial Markets: Current Generation: Example

- Example: Ghoulmie, Cont and Nadal, *Journal of Physics: Condensed Matter, 17 (2005): S1259-68*
- Takes main quantitative facts and reproduces them using an interacting agents model that is intractable mathematically for most parameter values and so is simulated using agents.

Agent-Based Financial Markets: Summary



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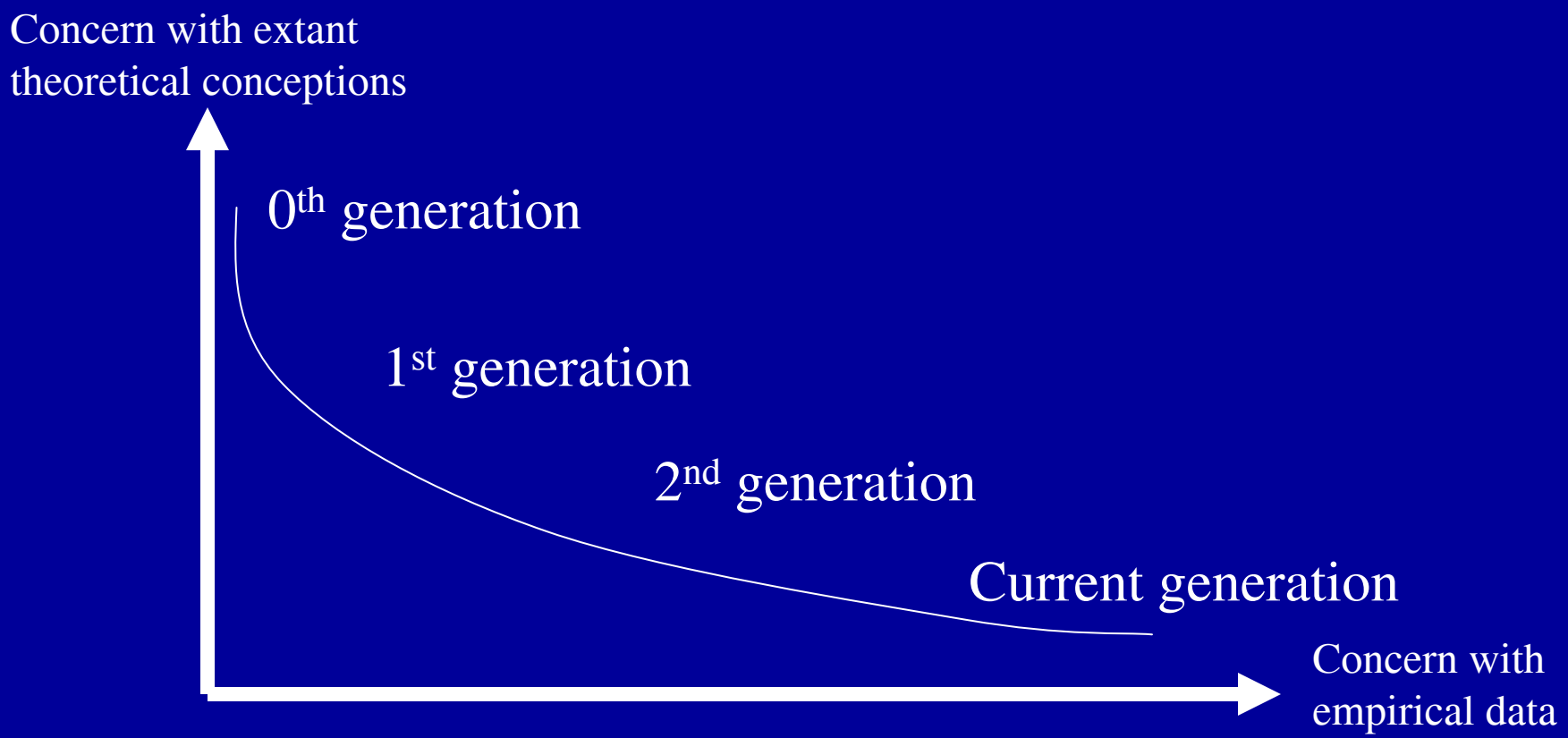

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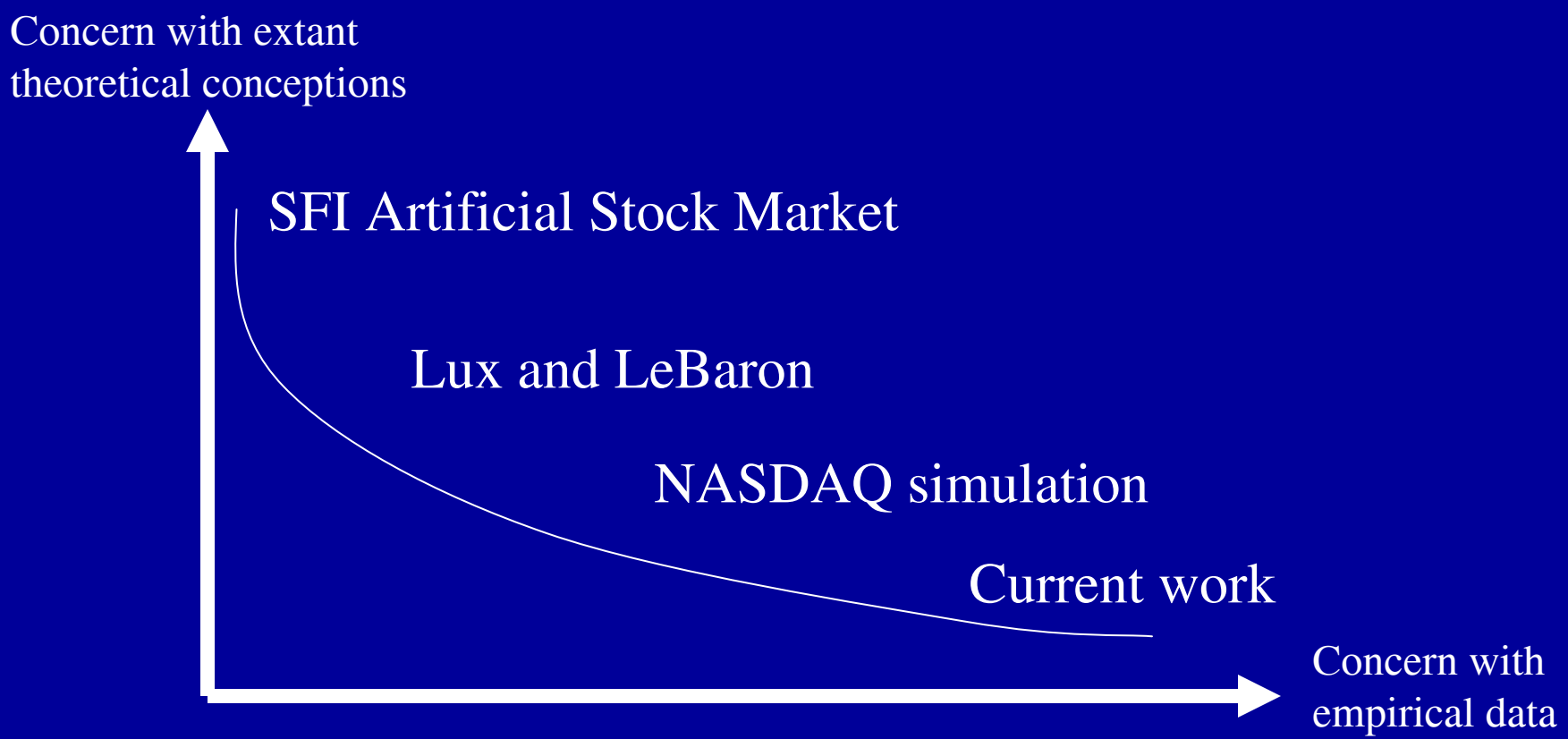

Agent-Based Financial Markets: Lacuna

- Why only 1 risky asset?
  - How do agents allocate resources between assets and asset classes?
- Why no bubbles?
  - Are fundamental traders too capable?
  - Is fundamental price to well determined?
- Why little attempt to utilize behavioral specifications?