Quantifying Realistic Uncertainty

In Recognition of
Gregory Chow and Xiaohong Chen

Lars Peter Hansen
University of Chicago

Award Ceremony for 2017 China Economics Prize

November 18, 2017

Gregory Chow contributions

- Testing for structural breaks
- Adapting control theory to economic applications
- Econometric modeling of the Chinese economy

Xiaohong Chen contributions

- Sieve-based methods for conditional moment estimation
- Copula-based methods for time series econometrics
- Temporal dependence in nonlinear models

Probability meets Social Science

Jacob Bernoulli (left)

Law of Large Numbers: how unknown probabilities are revealed (1713)

Dual Roles for Statistics in Economic Analysis

- Outside a model
  Given a dynamic economic model, researchers:
  - estimate unknown parameters
  - assess model implications

- Inside a model
  When *constructing* a dynamic economic model, researchers:
  - depict economic actors (consumers, enterprises) as they cope with uncertainty
  - deduce the consequences for market outcomes and resource allocations

Uncertainty components

- risk -
  uncertainty within a model: uncertain outcomes with known probabilities
- ambiguity -
  uncertainty across models: unknown weights for alternative possible models
- misspecification -
  uncertainty about models: unknown flaws of approximating models

Statistical Complexity: why should we care?

- When is it challenging to learn and draw inferences?
- When is there more scope for behavioral distortions?
- How might statistical uncertainty induce fluctuations in market prices and impact resource allocation?
- How should statistical uncertainty alter how we design policy responses to economic problems?

Statistical Complexity: what are some advances?

- Gregory Chow - conducted initial and important work on testing for structural change
- Xiaohong Chen - developed inference for methods that are semiparametric; allow for "explicit structure" along some dimensions and "flexibility" along others

Their contributions enhance our understanding of statistical complexity in different and complementary ways.

Confronting Uncertainty

- Decision theory - axiomatic - rational decision making
- Control theory - dynamic - practical application

Gregory Chow - pioneer in the use of control theory methods in economic dynamics

Recent advances:

- allow for alternative and potentially complex forms of uncertainty
- applicable to modeling economic agents and to guiding economic policy

Uncertainty and Financial Markets

Bear Bull Rumble, Adrian deRooy

Friedrich Hayek (1974)

"Even if true scientists should recognize the limits of studying human behaviour, as long as the public has expectations, there will be people who *pretend* or *believe* that they can do more to meet popular demand than what is really in their power."
(From Hayek's Nobel address)

Econometric modeling as a guide for policy

China has faced and continues to confront important and, in some ways, unique policy challenges

Gregory Chow - initiated econometric modeling of the Chinese economy

Uncertainty and Climate Change Policy

"Any serious discussion of the changing climate must begin by *acknowledging* not only the scientific certainties but also the *uncertainties*, especially in projecting the future. Recognizing those limits, rather than ignoring them, will lead to a more *sober* and ultimately more *productive* discussion of climate change and climate policies."

Steven E. Koonin (2014, former undersecretary for science in the US Department of Energy)

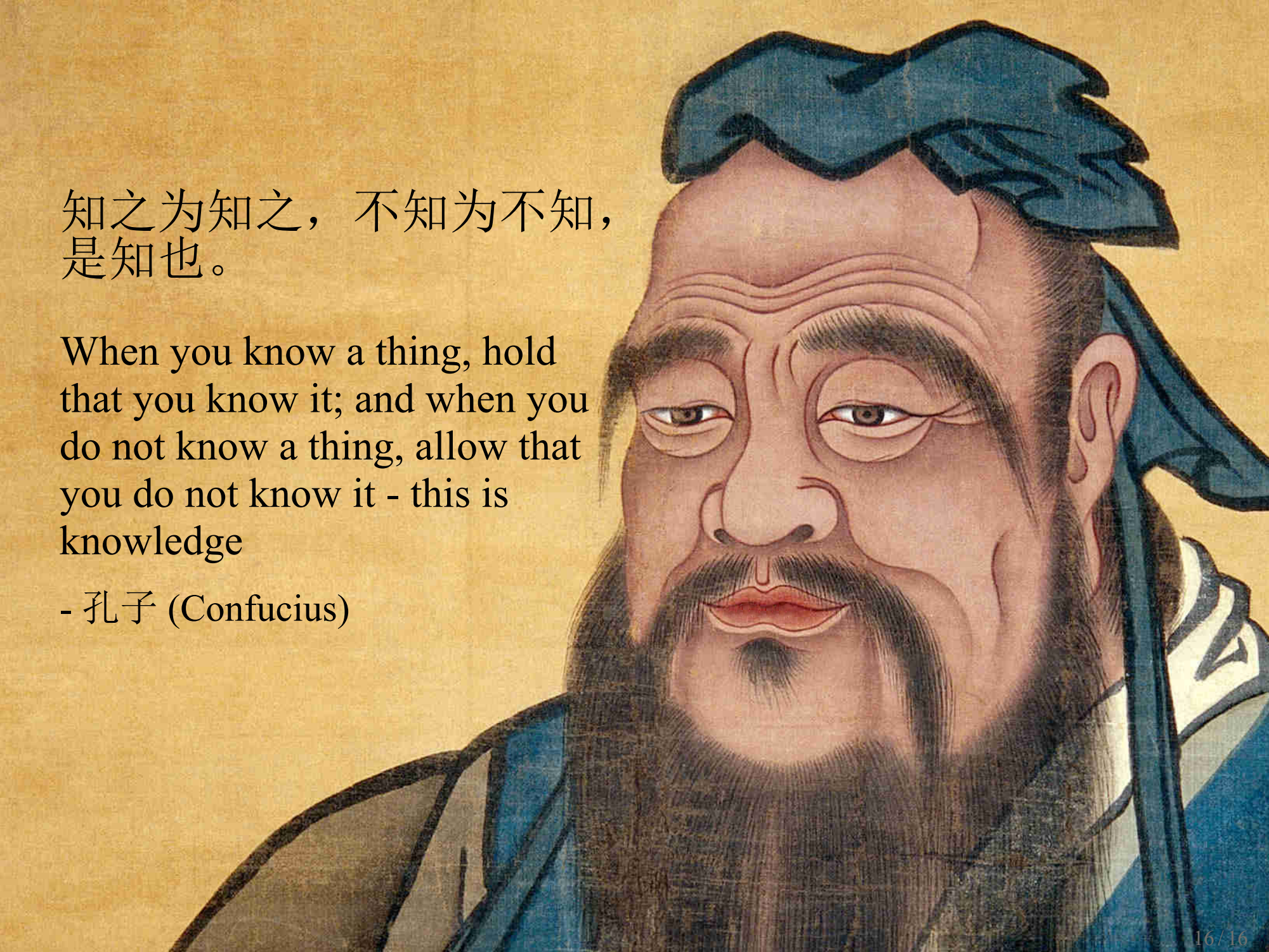
Uncertainty and Financial Market Oversight

- United States: Financial Stability Oversight Council (created in 2010)
- China: Financial Stability and Development Committee (just created)

Uncertainty and Financial Market Oversight: Challenges

- Systemic uncertainty: limited understanding of "systemic risk" which challenges its value as a guiding principle for financial oversight
- Nonlinear transmission: recent interest in macroeconomic models with an explicit role for financial impacts that induce nonlinearity in how shocks impact macroeconomy over subsequent time periods

Xiaohong Chen - provided important characterizations of nonlinear dependence implied by economic models and refinements of copula techniques designed for multi-dimensional nonlinear models



知之为知之，不知为不知，
是知也。

When you know a thing, hold that you know it; and when you do not know a thing, allow that you do not know it - this is knowledge

- 孔子 (Confucius)