UNCERTAINTY

Lars Peter Hansen – As an economist, I build mathematical models. It's really central to what I do. And why, well, we use mathematical models to represent clearly our understanding of the economy, to predict on what happens in an economic environment, like, suppose there's changes in government policies, tax policies, exchange rate policies, monetary policies, what happens? The models that fascinate me are ones that are ambitious enough to confront macroeconomic questions, questions that pertain to the whole economy, and rich enough to feature a role for financial markets. Uncertainty is central to these models, and how they are used. The models are dynamic, they capture that evolution over time of economic variables, they're stochastic, they include random impulses that are transmitted to the economy … And some attributes of these models must be revealed through data, that's where statistics comes into play. And that's a critical part of economics being evidence-based, is our willingness to measure, as well as acknowledge the uncertainty in our answers to important questions…

So people inside economic models make guesses about the future. So if I'm a model builder from the outside, I have to model people inside making these decisions. And the initial set of models I looked at the people inside the model had things figured out… They didn't know the future exactly, but they could, write down, yeah, they could make guesses, probabilistic guesses about what was going to happen, whereas I, the outside analyst, the statistician looking at the model, wasn't quite sure whether this was the right model, whether they had all the right ingredients, whether it might have been missing things, and the like… The outcome of my research and that of others was that puzzles emerge. In scientific disciplines, when you use models, they're not right! They're wrong, they have mistakes! They're not perfect! By their very nature they're not perfect! How do you use a model in a sensible way? That's another aspect of uncertainty, how, how do I take my simplified view of the world and adjust it to the fact that it's not quite, I know it's simplified, and it's not quite right! So this broader notion of uncertainty I thought which added a potential richness to this entire endeavor… Here I found it very valuable to again draw on multiple literatures: statistics, decision theory, control theory, all these, allowed me to look at richer characterizations of uncertainty.

I want to push it beyond the, kind of, simple-minded notion of, of a coin toss, where we know there's a 50 % chance that you get a heads, or a 50 % chance that they're getting tails, there, you don't know outcomes, but you know probabilities! We use simplified models, they may not be right, but we still think they provide useful insights into making decisions. How do we capture uncertainty in these much broader terms? How do we understand why financial

markets are bold, sometimes, and cautious other times? And how do we turn that into formal models, and the type of, by formally capturing how investors struggle, it opens the door to producing a kind of extra-richness in terms of how we think about financial markets. How about policy making? When we're trying to design sensible economic policies, we're doing this in a set of circumstances where the overall knowledge base of the economy is limited… This is true from the standpoint of thinking about monetary policy, fiscal policy, it's also true on thinking about climate change, and the economic impacts of climate change. We certainly believe that there's economic impacts that potentially affects climate change, but how big are they? How consequential are they? We don't have precise estimates on that. But yet we still wanna be making intelligent and informed decision-making … Thinking about uncertainty in these broader terms, I think, opens the door to having much more sensible approaches to thinking about economic policy design. It requires a more mature public, it requires a public that doesn't demand simplistic answers on the part of policy makers and economic advisers, and it allows the public to accept the fact that a discipline like economics doesn't have answers to everything…

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