

**NBER 2009 Macro Annual – Paper 5 Q&A**  
**Angeletos, La'O, *Noisy Business Cycles***

George-Marios Angeletos initiated the session by briefly responding to the discussants' comments. Both Robert King and Christian Hellwig had wondered if the paper's informational imperfection is the most relevant and quantitatively important propagation channel. Angeletos pointed out that the authors are not yet ready to make quantitative statements. Nevertheless, he discussed the key parameters of the model: the elasticity of substitution across islands and the price elasticity of demand of a particular good. The first parameter specifies the strength of trade links across islands and is a key determinant of the degree of complementarity, capturing the sensitivity of profits to aggregate demand. The second parameter pins down the monopoly power and is an important determinant of the cross-sectional properties of the model. In response to Hellwig's point that parametrizing the model involves a tension between complementarity and the response to idiosyncratic shocks, Angeletos argued that by generalizing preferences to separate the two parameters, one obtains a model in which the sensitivity to idiosyncratic shocks need not be tightly connected to the sensitivity to expectations of aggregate activity. Regarding the paper's informational structure, Angeletos noted that the noisy public signal is only a modeling device, not essential to the questions addressed in the paper. He stressed that the noise in the model is not the error in a public signal. Rather, the noise is the agents' correlated errors in forecasting economic activity. Finally, Angeletos urged the audience to take a more flexible approach to modeling information frictions, lest we fail to see the forest for the trees. He argued that specific information structures could be misleading by delivering specific results that are not robust to more general information structures. The essential result of the theory presented in this paper is that individual activity responds to (known) individual fundamentals and to expectations of aggregate activity. The micro data provides information about the former component, while data on forecasts of economic activity could offer information about the latter.

Jennifer La'O continued with a discussion of the cyclical properties of the labor wedge. Hellwig had pointed out that although informational shocks generate the desired counter-cyclical of the labor wedge, the productivity shocks work in the opposite direction, thereby yielding a pro-cyclical labor wedge unconditionally. La'O argued that since the main drivers of the business cycle in the model are the noise shocks, not the productivity shocks, the labor wedge does remain counter-cyclical. In response to King's comment about the fragility of the paper's welfare implications, La'O stressed that monopoly power only affects the level of output, which can be overcome with non-contingent subsidies to output. Since monopoly power does not affect the strength of strategic complementarities (which is determined by trade links across islands), it does not affect the informational externalities that drive fluctuations. Therefore, she maintained that the informational structure does not introduce any additional inefficiency.

Hyun Shin pointed out that it had been assumed that the coefficient measuring the degree of strategic complementarity should be between zero and one. He wondered what would be the consequences of having that coefficient be greater than one, in a well-defined model where the actions of agents are suitably bounded.

Elias Albagli wondered what role asset prices could play in aggregating and conveying information about aggregate activity.

Chris Carroll was enthusiastic about distinguishing responses to individual vs. aggregate conditions. But in his view, the real mystery was why people seem to respond a lot more to the aggregate signals than might seem sensible. He cited his recent work on consumption, in which he finds that the magnitude of permanent shocks at the individual household level is roughly 100 times as large as the variance of shocks at the aggregate level, which suggests that people ought to pay very little attention to aggregate shocks, at least if there is any cost of obtaining that information.

Nobu Kiyotaki pointed out that the paper deals with disagreement across agents regarding the aggregate state, rather than with uncertainty, as measured by the degree of confidence any one agent has about their own forecast. He pointed to the New York Fed's work on inflation data from the Survey of Professional Forecasters, which distinguishes between dispersion in expected inflation and inflation uncertainty for each respondent.

Michael Woodford took up Hellwig's connection to papers on asymmetric information written in the 1970s and 1980s. He noted that the earlier literature assumed that asymmetries of information had something to do with the structure of the world: certain things were not perfectly observable by certain agents because of actual barriers to the information flow. To verify such an assumption, one would need, as King had suggested, to measure the noise in the available public signals and to explain the source of that noise. But noisy signals are difficult to justify in the case of monetary policy, for example, since the Fed gives timely and precise statements about its actions. As an alternative, Woodford pointed to the recent literature that focuses on limits to information processing. This approach, explored in papers by Sims and Woodford, among others, generates noise from the inattentiveness of individual agents. The way to discipline the theory is to have a parsimonious theory of what agents optimally choose to pay attention to, rather than to model the structural barriers to information that agents must live with.

Angeletos found the different formalizations of the information structure as highly complementary. Many of these alternative formalizations are just specific restrictions on expectations; but once one reaches a representation of how activity depends on expectations of activity, he claimed that most of these formalizations look similar. He agreed with the criticism that it is hard to justify incomplete information about exogenous innovations to monetary policy. However, he argued that information about real shocks is widely dispersed, and it becomes interesting to see how monetary policy responds to shocks for which agents have dispersed information. The companion paper with La'O (2008) highlights that the response of monetary policy in such an environment changes the way in which the economy responds to these shocks in the first place.

John Geanakoplos recalled that one focus of the early literature was determining the extent to which having more information was beneficial. He noted the paper by Martin Hellwig (1982), in which people paid attention to prices in making their decisions, but they did not extract from prices all the information that could be extracted. He also pointed to a paper co-authored with Dubey and Shubik (1987) in which if agents had different levels of information about the state of the economy, and had to commit to quantities first, as in a Shapley-Shubik (1977) game, then even in a rational expectations equilibrium without any strategic complementarities, having a better signal mattered a

lot. He suggested that the authors drop the symmetry of the model, to explore the extent to which having better information matters in this model as well.

Phillipe Aghion built on Geanakoplos's point, suggesting that the authors make information endogenous, allowing agents to invest in learning. The authors could explore the link between the degree of competitive power and the incentives to invest in better information, thereby generating predictions about the link between market structure and the equilibrium amount of information.

Angeletos agreed that the endogeneity of information was an important point which the authors would explore further. He went on to highlight that in this model, the only thing that agents can do with better information is to update their forecast about aggregate activity. However, the role of learning is limited, since precisely when noise has the biggest impact on the business cycle (namely when complementarities are strongest), the forecast errors will be smallest, and hence any learning that may take place through prices or macroeconomic data will be least useful.

Ken Rogoff ended with a provocation regarding our perceptions of reasonable assumptions about the economy. He was struck by the contrast between the current paper and the papers related to the financial crisis in the current volume. He pointed out that historically, the truly serious business cycles have always been associated with big financial problems and he noted the theoretical work of Bernanke, Gertler, Kiyotaki, Moore, and others, which tries to model these financial amplification mechanisms. He wondered if the current RBC/New Keynesian frameworks are only suitable for small cycles, while missing the big waves: Is the RBC framework, with its elegant, simplifying assumptions that wave off issues in the financial markets, merely modeling "white noise" that we can filter out when looking at the big swings? Is the profession rethinking these central assumptions?

Angeletos found the RBC framework useful in revealing important amplification and noise effects that generate fluctuations even in a stark framework with no inefficiencies. He also felt that the conceptual point of the paper, namely that information frictions are an important way to generate uncertainty about aggregate activity, is highly suitable for thinking about financial markets and crises.