

CQER Letters

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Director's Note

by Tao Zha

This issue of *CQER Letters* reports on the conference *Models and Policies for Economies with Credit and Financial Instability*, held October 15, 2009, at the Federal Reserve Bank of Cleveland. The conference—sponsored by the Center for Quantitative Economic Research (CQER), the Bank of Canada, the Swiss National Bank, and the Federal Reserve Bank of Cleveland—was held to explore cutting-edge macroeconomic models that incorporate financial “frictions” or similar financial intermediation mechanisms that propagate economic shocks.

Economists from several universities and central banks gathered to discuss these models, share new empirical findings, and debate policy implications of the research. Nine papers were presented. Specific topics that were explored in relation to the broader theme of credit and financial instability included labor market search, market failure, asset bubbles, modeling monetary policy, the role of the banking sector, and the macroeconomic impact of credit constraints.

Zheng Liu, Pengfei Wang, and Tao Zha presented the first paper, “**Asset Prices, Credit Constraints, and Macroeconomic Fluctuations**,” which combines credit constraints with housing demand to account for the transmission channel of land prices that affects macroeconomic variables. Because firms are constrained by their land value as collateral, there is an important dynamic relationship between land prices and business cycles.

Next, Roger Farmer presented his paper, “**Confidence, Crashes, and Animal Spirits**,” introducing an alternative paradigm for Keynesian business cycle theory that maintains the main message of *The General Theory* but reconciles that message with Walrasian economics. In particular, Farmer’s paper introduces market

failure in an otherwise competitive model that deals with both an externality issue and a lemons problem.

Larry Christiano presented “**Financial Factors in Business Cycles**,” coauthored with Robert Motto and Massimo Rostagno, explaining how to construct and estimate a standard monetary DSGE—dynamic stochastic general equilibrium—model that includes financial markets. The model identifies a new shock that originates in the financial sector and accounts for a significant portion of business cycle fluctuations.

Peter Howitt presented the next paper, “**Computational Analysis**,” coauthored with Quamrul Ashraf and Boris Gershman. The paper attempts to answer the role banks may play in the context of financial friction models. Motivated by the fact that behavioral patterns in a complex economic environment can go beyond what any individual agent can comprehend, the paper proposes an agent-based computation analysis to replace a standard rational expectations approach.

Andreas Schabert then spoke about his paper, “**Modeling Monetary Policy**,” coauthored with Samuel Reynard. This paper develops a macroeconomic framework that incorporates monetary policy in a way that accounts for important facts that standard macroeconomic models typically neglect, such as a separate asset market, a liquidity premium on risk-free assets, and asset transfers among central banks.

To emphasize the role of bank capital in the transmission of shocks, Cesaire Meh presented “**The Role of Bank**

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Capital in the Propagation of Shocks,” coauthored with Kevin Moran, which studies a DSGE model featuring a financial accelerator, a bank capital channel, and nominal rigidities. Within this framework are two kinds of frictions in the economy: moral hazard on the part of entrepreneurs and moral hazard on the part of bankers.

After Meh’s presentation, Katrin Assenmacher-Wesche presented **“Financial Structure and the Impact of Monetary Policy on Property Prices,”** coauthored with Stefan Gerlach, on the extent to which monetary policy has predictable effects on property prices. This paper finds that monetary policy could slow property price booms but at the cost of a considerably weakened real GDP. The last two papers were presented by Vincenzo Quadrini and Charles T. Carlstrom. In Quadrini’s paper, **“Macroeconomic Effects of Financial Shocks,”** coauthored with Urban Jermann, discusses an RBC—real

business cycle—model with financial frictions and credit shocks to show that 1) standard productivity shocks can only partially explain the observed variations in real variables, and 2) financial shocks affecting firms’ capacity to borrow can bring the model much closer to the data.

Carlstrom finished off the conference by presenting **“Optimal Monetary Policy in a Model with Agency Costs,”** coauthored with Timothy S. Fuerst and Matthias Paustian. The paper integrates a model of agency costs into an otherwise standard dynamic New Keynesian model by identifying distortions caused by agency costs.

In conclusion, the conference was fruitful in the exchange of ideas on this pertinent subject in macroeconomics and finance. We are grateful to all the participants and the Federal Reserve Bank of Cleveland that hosted this conference.

CQER Letters

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Coming Events

The 7th Dynare Conference, on Structural Models and Policy Analysis, will be held September 9–10, 2011, at the Federal Reserve Bank of Atlanta.

For up-to-date information as the conference approaches, visit frbatlanta.org/cqer/eventscq/.

A Conversation with Larry Christiano



An adviser for the Atlanta Fed's Center for Quantitative Economic Research (CQER), Lawrence Christiano is a professor of economics and the Alfred W. Chase Chair in Business Institutions at Northwestern University in Evanston, Ill. His research has two parts: one involves formulating and estimating models of the economy that

fit the data well, and the second involves deducing the implications of those models for monetary and fiscal policy.

The following conversation is excerpted from an interview that took place in August 2009 with Tao Zha, CQER director, and Michael Bryan, vice president and senior economist with the Atlanta Fed's research department. Christiano talked about how the recent recession and financial crisis has changed the role of the Fed.

Mike Bryan: *Let's start with you. What are some of the things you want to talk about?*

Larry Christiano: In many ways, the world has changed in ways that aren't going to be undone very soon. Our conception of what monetary policy is now is very different than what it was before. Before, we thought of the Fed as buying and selling short-term Treasury bills. Now we think [of it] in terms of the possibility of buying also long-term Treasury bills, which creates potential problems of capital gains and losses for the Fed. But that's only a small step, because the Fed has now also bought mortgages, bought commercial paper...it's bought a stake in AIG and some other companies. So what it is the Fed does, we have to think differently about that.

When we think in terms of research about what the Fed does, we have to write down models which can accommodate some of the things the Fed has done. What it boils down to is that in many ways the Fed has stepped in and replaced fundamental parts of the intermediation system, by lending directly in commercial paper and stuff. Those things aren't available—current standard models simply don't allow us to think about what that might mean. But there's a second dimension on which things have changed. (This is relevant for researchers.) Our models have never fully integrated financial factors into business

cycles, and now it's very clear that in order to have a serious conception of how the economy is put together—the dynamics of the economy, and so on—we're going to have to have models that are sophisticated not only in terms of labor markets, goods markets, maybe foreign-exchange markets, but, in addition, financial markets.

So these [are the] two big changes that are going to be with us for the next decade or two decades: one is we're going to broaden our thinking about what is monetary policy, and the second—which is actually related—[is]

“For example, after the 2001 recession, the Fed dropped interest rates very substantially. Undoubtedly, that drop in interest rates made the economy stronger than it would have been otherwise. That has huge tax implications.”

we're going to be working very hard to expand our models to accommodate a perception we now have that financial markets really matter.

Bryan: *I want to come back to that in a bit, because I know you have several papers floating around now that take financial frictions much more seriously. But can I interpret from your first point that you're not a big fan of the credit policies of the Fed since the fall of 2008?*

Christiano: That wouldn't be the right characterization. I think a fundamental task of a central bank is that when there are occasions when private markets grow uncomfortable with privately-issued IOUs and really want government-type paper, in order to do trades with each other—I believe, actually, that the beginning of the Great Depression was triggered by precisely such an episode. I have a published paper that formalizes that idea. The episode then was that private people, for reasons not so clear, no longer wanted to hold stocks, bonds, even demand deposits. They just wanted to hold plain, old-fashioned government currency. I think that's what happened in 2008.

Now, I think the right function of a central bank is, in a time like that, to in effect swap all the stuff that private guys don't want to hold anymore (that private stuff) and

exchange it with the public stuff (the government currency) that they so much want to hold. I think the big problem with the Great Depression is that the Fed did not do that. Even though, according to its charter, it was supposed to do that, actually, the Fed didn't do that....

Now, the Fed took a very different position and very actively exchanged private for public paper. The way you can see that is if you look at the assets side of their balance sheet, which expanded enormously. It now includes all kinds of privately-issued paper. And the liabilities side, by definition, has to expand by the same amount, pumped out a lot of government paper. At that level, I would think of this as a big demand for liquidity shock, and the Fed accommodated it, and I think that's an appropriate function for a central bank.

Bryan: *A lot of people have been critical that, somewhere in that process, monetary policy has crossed the line into fiscal policy, and that's a line that shouldn't have been breached.*

Christiano: There's two levels at which one can address that comment. The first, as a narrow legal issue: does the Fed have any right to go in and purchase private paper like it did? The answer is, yes, it does. The Federal Reserve Act says very clearly that under exigent circumstances, the Fed may go in and buy that paper. It's very much consistent with the legal mandate of the Fed to go out and do what it did do, and because it's very much consistent with what central banks should be prepared to do, I agree with the stuff they did.

Now, it's true that, by buying all this privately issued paper, the Fed has wandered into a fiscal policy neighborhood. In thinking about that, you have to think of two issues. The line between fiscal and monetary policy is a funny line. In actual fact, every monetary policy action the Fed does, even standard monetary policy, has important fiscal consequences. For example, after the 2001 recession, the Fed dropped interest rates very substantially. Undoubtedly, that drop in interest rates made the economy stronger than it would have been otherwise. That has huge tax implications. It changes the revenues the Fed earns. Most Fed actions have fiscal implications.

Still, I understand what you're saying. Did they go into some new territory when they bought assets? Yes, they are in new territory. The difference is: when they decided to pump money into AIG or when they decided to put money into Bear Stearns through the Maiden Lane facilities...the Fed actions at that point affect citizens whose names you can actually state.

Normal Fed actions, which buy Treasury bills, kind of affect the country as a whole. You can't say, "This action helped Sally but hurt John." But in the case of

AIG or in the case of their decision not to intervene with Lehman Brothers, and so on, there is something different from ordinary open-market operations, because it affects individual people. And traditionally those actions which affect individual people are done by the Treasury. And with those actions, when the Treasury does something, appropriately, Congress gets involved, as it should in any democratic society.

So what the Fed did in 2008 is different from what it's used to doing. It's within its legal mandate, but it is kind of different. And it raises some potential problems for the Fed. The big potential problem is that once it wanders too far into stuff that looks like Treasury policy—that is, policy that affects Sally and John and Jake and so on—then the Congress naturally wants to get involved, and, in fact, [it] has become involved. In fact, I believe the Fed has opened the books on Maiden Lane to Congress, and allowed Congress to look through those activities. And that sets

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a potentially dangerous precedent because it challenges the position of the Fed as an independent institution apart from the rest of the government.

Now that, I think, is potentially very dangerous. At the present time, Fed independence is more important than it ever was. Because at the present time, it has been completely established—without any doubt—the Fed needs to have flexibility of action, needs to act creatively, as it did in 2008. What that means is, with all this flexibility, we can't impose simple rules on the Fed to make sure it's independent of the meddling of the Congress. As soon as it's very creative and if the Congress is involved, you run into the danger that short-term considerations will enter into Fed policy and we potentially will have some very serious problems.

Bryan: *Correct me here: you seem to have softened a little on your view of the Fed actions in the fall [of 2008] from your paper you wrote with [Patrick] Kehoe and [V.V.] Chari [“Facts and Myths about the Financial Crisis of 2008”]? At that time, you have these “myths”—and we can argue what is a “myth,” and what the underlying data show—but there was a tone to that paper that indicated that the Fed had taken steps that go way beyond*

what the data suggested, and it was incumbent upon the Fed to tell the world what the hell it was doing. Have you softened at all on that position?

Christiano: I don't know yet what I think. Let me just say clearly what we say [in the paper]. The opening sentence of that paper began with: "Clearly, the United States is in the middle of a very severe financial crisis. The ancient, storied investment banks have gone under. Clearly, we have a major problem on our hands."

The question the paper raised was, "What exactly is going on?" The problem is that, at that time, as now, when we think of the U.S. banking system, we can split it into two parts. One is the commercial banking system; it is the part that is regulated and very well covered by data. The Fed has numerous surveys of what that part of the system does, what its books look like. Then we have this other part of the banking system, the "shadow" banking system.

The problem is that for the shadow banking system, we have very little systematic data. The problem that occurred in 2008 was that politicians and high public officials were saying that the banking system had dried up and wasn't making loans, and so on. But the only measured part of the banking system—the commercial banking system—did not support that, actually had the opposite implication. In the fall of 2008, ordinary citizens really couldn't see this evidence. It emerged over time that a lot of the evidence that people in the Fed were looking at couldn't be made public: a lot of it was, for example, evidence the Chairman could get by asking people to go over to Bank of America, looking inside, and report back. That kind of information may not be released to the public. Our paper was a cry of frustration over the fact that we did not have any data to quantify what was going on. What small amount of data we did have seemed to indicate the opposite of what public officials were saying.

Of course, we now know what was probably going on was large parts of the shadow banking system were imploding. The asset-backed securities market, for example, just collapsed. The commercial banking system was expanding, in a healthy way, to partially offset the collapse of the shadow banking system—but probably only partially. The frustration remained in that we were not able to see any of the data that got people pulling alarm bells and being very, very concerned. And I remain frustrated with that.

And my guess is that one positive outcome of all this is that as we begin to regulate the shadow banking system more (which we obviously will, partly because we're bringing big chunks of the shadow banking system into the commercial banking system, like Goldman Sachs)...

as the regulatory net expands, inevitably we get more and more data.

So this problem, that policymakers had to make really important decisions based on evidence that wasn't available to the rest of us, hopefully will not be a problem in the future. One of the things we've learned in the last 20 years—an agreement we've all reached—is that transparency in monetary policy is absolutely critical. And to be in a situation where important monetary decisions are taken, when the evidence on which those decisions are based cannot be reported to the public, is of course very untransparent. And everyone involved agrees that that is very undesirable. We want to make central banking transparent.

And I think that was the message of the paper. Any issues of tone—or any reactions to the tone of the paper—just reflect bad writing on our part. That is a regrettable thing: you don't want to write a paper where people react to the tone and not to the substance of it. To the substance of it, I'd like to stand by. Any offense people may have taken to the tone, I totally would want to distance myself from that and wish we hadn't written it like that.

Bryan: *So your work is almost exclusively on monetary transmission mechanisms. I think of it as the Holy Grail of macroeconomics—the big puzzle. Why there? Why such a huge task?*

Christiano: Ah. Well, the answer to that is probably very simple. For reasons I don't recall right now, I spent a huge amount of time in central banks. When you spend a lot of time in central banks, you end up thinking about the issues that come out at central banks. I suppose if I spent

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time at the U.S. Weather Bureau, I'd be struggling to forecast the weather. I think this is a side effect of the Federal Reserve System, since the late '70s made a big, important shift in the direction of supporting research—not basic research, but towards supporting research inside the Federal Reserve System. This had always happened at the Federal Reserve Board—in fact, they've had very good econometricians there forever. In fact, I think they had a professorship-type chair at the Federal Reserve Board for

a long time. Of course, the Federal Reserve Board is very big, so it can afford to keep its fingers in different things. The notion of academic research was not entirely foreign at the Board, but it was in terms of Federal Reserve Banks. At least in my experience, in Minneapolis in the early '70s, the old regime was actually opposed to research—that was a waste of time. Any evidence you were doing research—say, if you got a publication—would be evidence you weren't

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actually working. That changed dramatically in the late '70s, into the '80s and '90s. What happens under those circumstances is that people who like to think about putting together models, if they stumble into a Federal Reserve Bank and hang out for a while, they'll end up working on those problems.

Bryan: *So over that period, what do you think are some of the big insights? Some of the breakthroughs?*

Christiano: There is a major breakthrough that accounts for the fact that Federal Reserve Banks (and central banks all over the world, actually) started to make commitments to research. It was a major success, you could say. The major success was—there was a major puzzle in the '70s, which is, how in a democratic society, could an important institution of government (the Federal Reserve) do something that seemed destructive to society, by permitting high inflation? And economists came up with, I guess, an ingenious answer to that, which is Kydland and Prescott [in their classic 1977 paper, “Rules Rather than Discretion: The Inconsistency of Optimal Plans,” in the *Journal of Political Economy*].

Actually, earlier, [Guillermo] Calvo argued there was a problem inside monetary policy—they called it the time-inconsistency problem. They provided a way of thinking of how central banks could apparently preside over these bad things, e.g., high inflation. I think that was viewed as a major, major success. And along with that came a higher prestige associated with economics. And I think that helped fuel this shift towards research. We don't see that within Treasury departments—you don't see economists

doing research there. I think the reason is there was a major success in economics within the context of monetary policy, but there wasn't any analog success during this period within Treasury departments.

Tao Zha: *To switch the topic: As an adviser to the Center for Quantitative Economic Research (CQER), the new center within the Federal Reserve Bank of Atlanta, what would you advise the role of CQER to be within the system? And also within the economics profession as a whole?*

Christiano: I think that the economics profession as a whole has, in some way, fallen down in recent times. I want to answer your question, but I need to start out a little broader. Actually where you ended up, I'm going to start, with a broader perspective. I think the economics profession as a whole went through a revolution in the late '70s, a revolution that sparked huge amounts of creative work and insights, including the Kydland and Prescott insight. And during that period, especially macroeconomists and monetary economists were forced to become theorists, because they had to learn basic things about models they didn't know before, that's what the revolution was all about.

So they adopted the values of a theorist. A theorist tries to articulate ideas, and they want to do it in the simplest possible setting, which keeps out all the unnecessary elaborations and complications just to articulate that one idea. And that was a very important phase that monetary macroeconomists went through. That phase amounted to, among other things, a complete rejection of earlier work that was done in macroeconomics, for example, that was done at the Board, where large economic models were constructed of the U.S. economy, models that could go up to a thousand equations. And of course that is completely against the theorist's values—those equations aren't simple, they don't strip away things, they're complicated.

Zha: *Calvo's foundation? Klein-type econometric models?*

Christiano: Calvo's foundation, I think, partly as associated with a theoretical framework for thinking about econometrics, for the Klein-type models. So in that sense they were also theorists; they were telling us how to do econometrics. But the Klein models are what I have in mind—those were anything but simple. There were not theorist's things at all. They were not pretty, and they were designed to explain the United States economy. That is not a simple thing. It is completely contrary to the values of a theorist, if you want to explain the United States economy.

So, anyway, monetary economists and macroeconomists went through this phase that was extremely important, absolutely necessary, of all of us becoming little

theorists for a while. I think the problem, and one of the problems we have in dealing with this crisis, is that this theory phase went on too long. People are very reluctant to synthesize, for example. We have models of financial frictions, models of labor markets, models of goods markets, of international trade—we have all kinds of models of different things, and each one is a beautiful poem itself, beautifully consistent with the values of theorists. But the traditional hard work of macroeconomists—of integrating all those things—was never done so that you [would] have something you can use to explain data. I think the theory phase went on too long, and as a consequence, we don't have an integrated model for understanding, for example, even the 2008 financial crisis.

Now, to go back to the Atlanta Fed situation: I think that the [CQER] is very much a part of the solution to the problem, and that's why I'm interested in it. The Atlanta Fed center wants to encourage the construction of synthesis models of the U.S. economy, models that aren't necessarily simple, but integrate a lot of the stuff we know about economies, about labor markets, and so on—integrate them all so we can understand the United States of America, [with] 300 million people, an enterprise that's going to take more than one or two equations. And it will not be sufficient—not even close to sufficient—to be a good theorist, to construct that kind of model.

In addition, the center already integrates excellent tools, the kinds of tools that are needed to build models of the economy—like all the numerical, computational tools. People there have those tools, people participate in that stuff, and know about technical issues like solving models, econometric issues, and so on. So I think that this center is exactly fixing a problem we have now—although the pressures of the world will come down so hard on everyone, that everyone I think will be working on synthesis models.

But, still, I think the Atlanta Fed is well-positioned, has the resources, has the right values, the right focus, that I think it's going to make an important contribution to this new synthesis way of thinking about things.

Bryan: *So you were instrumental in bringing DSGE [dynamic stochastic general equilibrium] models into the central bank. Where do you think that stands right now?*

Christiano: Well, what's interesting is that you might have thought central banks would say, "Geez, these models are useless. We had this big crisis and nobody forecasted it. This is useless stuff." The truth is, it seems the opposite has happened. I travel around a lot to central banks—I was just in Chile, for example, I'm going to go to Peru, I was just in Brazil, I'm going to the Czech Republic, Hungary—lots of different places that I go to, where I talk about models. And

the hunger for that has gone way up! People really want to see these synthesis models, they want to see models that integrate. For example, I did a big project at the Riksbank, in Sweden, where they wanted to have a model that integrates the best that we know about labor markets, as well as what we know about financial markets, into a model that would be suitable for policy analysis in Sweden, and to take into account the special circumstances of Sweden, which is that it's a small and very open economy.

So I think what's happening here with these DSGE models is the interest in these models is going to explode. The capacity to deal with this interest is, amazingly, very strong. It's striking to me, if I go to Turkey, go to Chile—I go to all these various places—everywhere I go, I find extremely well-trained economists. I didn't go to Turkey 30 years ago, but I'm thoroughly convinced that if I did, they wouldn't have highly qualified economists in their research departments in those days, just as we didn't have anybody like that at the research department in Minneapolis in those days, in the early '70s. So I think there's going to be a big expansion of interest as a consequence of what's going on.

So two places I think deserve note. The Bank of Japan has a very interesting project underway.... They're trying to build DSGE models where they can think about the balance sheets of private banks, and they can think about what happens when those balance sheets go bad, they

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can think about going in and bailing out banks. That is to say, they have models to think about the kinds of policy questions central bankers are thinking a lot about! And the Canadians are doing the same thing.

Zha: *Have these models gone under academic scrutiny?*

Christiano: Yeah. The Bank of Japan model is a very natural extension of the now classic Bernanke–Gertler–Gilchrist [BGG] model. In fact, ironically, I had a student who did that in his thesis a long time ago. And nobody was interested in his work. “Why would you want to bring in financial frictions? It

just complicates everything. You can't understand it when you bring in financial frictions. You need to have models with two equations, not three or four." So he did not do very well. But, then again, that's the theorist's ethic.

Bryan: *Whatever happened to him?*

Christiano: He's Chinese. He ended up at Peking University. But he's not there anymore, he moved somewhere else, but I can't remember where he moved. But he's not participating in these exciting new developments. I'm sorry about that. But I think three guys at the Bank of Japan are going to do well.

Bryan: *So do you think these DSGE models are the most exciting thing going on in monetary economics?*

Christiano: Yea, they're probably the only thing going on. They're the only thing going on in the sense that the theory of these things is pretty well understood. There remains kind of a theory question that's outstanding. But, generally speaking, the theory of these models is pretty well understood. So the theorists are not that involved in making basic contributions. I can envision the possibility of some theory contributions being required.

For example, the monetary DSGE models take a pretty simplistic stand on fiscal policy and taxation. But at the same time, we know that monetary policy has fiscal consequences, even when you're doing normal monetary policy, because it affects how rapidly the economy is moving and therefore what the tax revenues look like—and also what much of government spending looks like, because a lot of that responds to the economy. So the fiscal position of the government is influenced by monetary policy. How the fiscal position is resolved, at some level, is important for understanding the full consequences of monetary policy. So if I want to start fighting inflation by raising the interest rate, and I create a little bit of a recession—well, then, the full consequence of that is going to...depend in part...[on] how does fiscal policy respond to that recession. For example, if it raises taxes, the recession will be even worse.

So as the U.S. government gets bigger—and I think it's inevitable now it's going to get bigger—the taxes are going to grow. It's inevitable. I know this is a horrible thing to say, but when we look into the future, we don't see any scope for reducing expenditures which don't require taxation. We look at Medicare, Medicaid—everybody's getting older, we're talking now about health insurance. We're seeing that government is getting larger, and a lot of people are mad about that, we see this in the town hall meetings about health insurance. But I think the government will only get larger.

So the simplistic views people have taken in DSGE models in thinking about the fiscal consequences of monetary policy are going to be less palatable. So we're going to need some very serious thinking about how to integrate the fiscal and the monetary policy in simultaneously. And I actually have been involved in very early work on that, in 1992, with Chari and Kehoe. And what I learned from that work was that doing this very carefully is extremely difficult. So we need some clever, creative people who will know how to—I don't know if this is the right phrase—"cut the corners," to creatively do things so it's manageable, yet in an interesting way addressing this problem of integrating fiscal and monetary policy. That is going to take some real creativity, and I think some theory-type work. Good theorists can be of assistance in that exercise.

Then there's another dimension, too, that has to be addressed when you're talking about what are the big issues in monetary economics. There is a modern consensus that has emerged that we don't have to think seriously about why people want to hold money when we build our DSGE models, and the current family of DSGE models completely reflects that view. That view is not totally uncontroversial. There are people out there who say it makes no sense to model money without modeling money demand. They say, "If I'm modeling the market for apples, then a crucial input into my model for apples is why people like to eat apples." At some level, that seems very natural, and if those guys are right, then we got some

“For example, we don't include a market for peanuts in our models. Peanuts are not obviously a very big part of the U.S. economy. Thinking about why people eat peanuts, and how many they have, and which days of the week they eat [them], obviously makes no difference from the point of view of understanding the broad outline of the U.S. economy.”

serious theoretical work on our hands, to integrate money into the model. My own belief, feeling is that the current consensus is correct, and that ignoring the reasons why people want to hold money is probably the correct thing to do. But I have to acknowledge that there are a few people out there who are smart and who disagree with

that view, and thinking carefully about why people want to hold money is a serious theoretical challenge.

Zha: *So the so-called “short cuts,” having a cash-in-advance model or money in utilities, what do you think about those short cuts in trying to model money demand?*

Christiano: So my understanding from the research on more serious motivations for holding money is that the basic conclusions of that research are all the same as what you get if you just put money in the utility function. So my sense is that no one has ever dominated money-in-the-utility-function models to reach different conclusions, or whatever. However, once you’re thinking of the family of money-in-the-utility-function models, then if you structure the model so that people hold about as much money as you observe in the actual data, or they hold essentially no money—it makes no difference. That’s the rationale for why people don’t model the demand for money in models. The amount of money held in the economy seems too small to make any big difference when you’re writing down an economic model.

That’s not to say credit isn’t important. The flows of credit seem to be very important; the terms on which credit is extended seem to be very important. But quantities of money—like if you think in terms of the balance sheet of the financial sector, you can think about the assets side and the liabilities side. Money is what we call the various things on the liabilities side. M1, M2, and M3—all that stuff, those are liabilities. And then credit is the things on the assets side. The assets side seems to be very important.

Zha: *So are you saying that modeling the demand for credit can be very important?*

Christiano: Yep, the demand for credit, but also the terms on which credit is extended. For example, a standard approach to this is the assumption—I think, the very reasonable assumption—that the amount of credit you get is a function of the value of the assets you have. That is to say, a creditor is willing to lend you \$100 if they see you have some stuff that could be sold in the event you can’t pay back that \$100. That’s a collateral constraint, and it is part of the terms on which credit is extended, the requirement that you show enough collateral in order to borrow. And that requirement—that you show enough collateral when you need to borrow—has a big impact on our models, and it matters a lot.

Zha: *More so than money demand?*

Christiano: Whereas money demand seems to matter not at all. I finished a project recently where we model M1, M3—all the details of the liabilities side of the banking system. And in all those details we include lots of shocks:

shocks to the demand for M1, shocks to the demand of M3, even shocks to the demand for reserves on the part of banks—all kinds of shocks, all over the place. And what we find is that a) those shocks play zero role in accounting for the volatility of variables in the data, and b) the presence of all these things don’t affect the way nonmonetary shocks (or other shocks) propagate through the economy—so provides neither impulses nor propagation mechanisms.

Zha: *Well, ironically, monetary policy research started with people looking at reserves, the federal funds market. [Steven] Strongin at the Chicago Fed started doing the empirical work. And, later on, leads to your famous Christiano–Eichenbaum–Evans (CEE) papers, [in] which you model monetary policy explicitly in terms of the liabilities. So are you saying that we need to take other parts of that model that are useful but not the particular way you’re modeling money? And your particular way of matching the monetary policy shocks coming from that kind of rule? So are you changing your views about how monetary policy should be modeled?*

Christiano: In the case of monetary policy shocks, we actually have another paper where we talk about this stuff. There’s equivalence between thinking about monetary policy shocks as hitting the Fed’s decisions about what to do about money per se, and monetary policy shocks as they hit the interest-rate-targeting rule. The reason for that is—suppose the Fed is following an interest rate rule, if there’s a shock to that rule, say the interest rate goes up 25 basis points, what that means is that the Fed has to dive into the money markets and actually make a change to some monetary aggregate. But then you could equivalently just think about how they changed their views about how to change the monetary aggregate as a function of the shock. So there’s an equivalent to those two ways of modeling money. The paper was called “Modeling Money.”

Zha: *Whatever happened to that paper?*

Christiano: I think it actually became the CEE paper. That result about the equivalence, I don’t know if that actually survived in the CEE paper. So I think there’s equivalence to thinking about policy in different ways—for example, interest rate rules and monetary rules. Now, the reason why I think, in the CEE thing, the money demand part is redundant is the following: if you structure that model we had in there, and you imagine the Fed is following an interest rate rule as opposed to a money rule—and again, there’s equivalence between these two things, but suppose they’re following the interest rate rule. Now, we modify the model so people want to hold less and less money, and we look at all the properties of

every one of those models, where money is less and less important—all the properties are the same! The impulse response function to a monetary policy shock is unaffected, the impulse response to a technology shock is unaffected, and so on.

Even more than that, if you look at optimal policy—so-called Ramsey optimal policy—not affected by money. But that's under the assumption that you put money in there to the extent that it is in United States data. The velocity of money is maybe 3, maybe 5, maybe 6-something, depending on exactly what aggregate you're interested in. If you model money so that, on average, that's the velocity of money, and then you change the model so that velocity goes to infinity, so that people aren't holding any money, there's not much difference. Of course, if you had a model where money was a huge amount, where velocity was like 0.005, then the properties would change a lot as you went off to infinity.

Zha: *Like hyperinflation countries?*

Christiano: Yea. But the point is, given the amount of money people hold in the actual economy, the reasons why they hold it don't seem to matter for other things. That's very much conditioned on the first things I said, given the amount of money people hold.

It's not surprising if you think about it. For example, we don't include a market for peanuts in our models. Peanuts are not obviously a very big part of the U.S. economy. Thinking about why people eat peanuts, and how many they have, and which days of the week they eat [them], obviously makes no difference from the point of view of understanding the broad outline of the U.S. economy. And it turns out the quantity of money people hold is also small relative to the scale of the economy, and given its size, it doesn't seem to matter.

Models and Policies for Economies with Credit and Financial Instability

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Federal Reserve Bank of Cleveland

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Asset Prices, Credit Constraints, and Macroeconomic Fluctuations

Zheng Liu, Pengfei Wang, and Tao Zha

Previous work has shown that establishing the empirical significance of the amplification and propagation channel through endogenous credit constraints is a challenging task. Credit constraints can be an amplification and propagation mechanism that transforms the shocks hitting the economy into the observed business cycle fluctuations. A financial multiplier can be an effective business cycle amplification mechanism only if the model can generate large fluctuations in asset prices and interactions between asset prices and investments. By combining credit constraints (in the manner of Kiyotaki and Moore [1997]) with a housing sector, this paper shows that in the presence of financial frictions, housing demand shocks account for 90 percent of land price fluctuations, 20 to 35 percent of output fluctuations, and 35 to 45 percent of investment fluctuations at the business cycle frequencies.

Starting from the empirical fact that strong co-movements exist between housing prices and macroeconomic variables, Liu, Wang, and Zha construct and estimate a dynamic stochastic general equilibrium (DSGE) model with endogenous credit constraints and provide strong empirical support for a link, or transmission channel, between asset prices and business cycles. They estimate the DSGE model to fit U.S. data and impose nonlinear restrictions on a subset of parameters to match first moments in the data to help identify other parameters of the model. In addition, Liu, Wang, and Zha identify housing demand shocks directly and evaluate them by their direct impact on asset prices. The authors show that movements in asset prices are critical to the amplification of macroeconomic fluctuations. To generate persistent co-movements between asset prices and aggregate quantities in a model, it is crucial to constrain firms by the value of their collateral assets.

During the seminar, participants discussed how the model is a parsimonious presentation of the quantitative importance of credit constraints and the two-way interactions between asset prices and aggregate quantities. Discussant Alberto Ortiz-Bolanos noted that the work, due to magnitude and relevance of income distribution, has significant policy implications. He also mentioned that the authors' findings are consistent with previous work in physical capital markets, which has focused on the relevance of shocks to the marginal efficiency of investment. One participant questioned whether the estimated innovations to housing preferences can survive an exogeneity test. Another partici-

part suggested that the paper disentangle the sources of the long-lasting increases in house prices, which are likely the result of changes in demand for collateralization motives or the high persistent shock process. Zha responded that future work will extend the analysis to incorporate capital movements and perhaps shocks to the marginal efficiency of investment.

Confidence, Crashes, and Animal Spirits

Roger Farmer

In recent decades, Keynesian economics has been attracting a lot of attention from economists. The positive part of the Keynesian revival is the recognition that sometimes markets fail, and, when they do, government policy can intervene to improve human welfare. The negative part of the revival is that policy economists throughout the world are rushing to dust off their copy of Samuelson's introductory textbook and blindly applying fiscal policies that do not have a history of success.

This paper introduces market failure in an otherwise competitive model that combines an externality with a lemons problem. Farmer argues that the equilibrium business cycle theory that has guided macroeconomics for the past 35 years is flawed. He introduces an alternative paradigm that retains the main message of Keynes's *General Theory* and reconciles that message with Walrasian economics. Farmer examines two market failures in the labor market in his paper: a lemons problem and an externality, which could potentially lead to inefficient equilibria whereby the self-fulfilling beliefs of stock market participants determine the unemployment rate.

A key assumption in the model is that firms do not perceive that their search effort changes the effectiveness of search in the economy. The source of the inefficiency of the equilibrium is that pessimism leads to low employment and a small number of recruiters with high productivity, which in turn leads to low aggregate demand. Farmer builds a simple model that is a variant of a "Lucas Tree Economy," populates it with a representative agent, and endows it with a single unit of non-reproducible capital. In the model, competitive firms that rent capital from households and employ workers each period produce output. This model mainly differs from the standard model in the way that Farmer models the labor market by adopting a variant of search theory. He concludes that the world economy is currently headed rapidly towards a high-unemployment, low-wealth equilibrium, which was triggered by a loss of

confidence in the value of assets backed by mortgages in the U.S. subprime mortgage market. The inability to value these assets has since led to an amplification of the crisis as panic hit the global financial markets.

During the seminar, participants discussed how the model captures the original spirit of Keynes's ideas, which suggest that the labor market is special and animal spirits drive the economy. They agree that persistent high unemployment is an equilibrium phenomenon, and most equilibria are inefficient. Discussant Katrin Assenmacher-Wesche expressed her concern regarding the way Farmer set up the research for the paper. She pointed out that the labor market is special for many other reasons, such as the sunk cost of investing in human capital, long production (education) lags, preferences, institutional barriers, and so on. One participant noted that to find an empirical proxy for the productivity of recruiting is difficult. Farmer agreed but suggested that the increase in the perceived productivity of recruiting explains the consequences of stock market crashes in the labor market.

Financial Factors in Business Cycles

Lawrence Christiano, Robert Motto, and Massimo Rostagno

In recent decades, interest in understanding the interaction of financial markets and the macroeconomy has been considerable. Questions about whether shocks originate in financial markets (i.e. "bubbles," "irrational exuberance"),

"Farmer examines two market failures in the labor market in his paper: a lemons problem and an externality, which could potentially lead to inefficient equilibria whereby the self-fulfilling beliefs of stock market participants determine the unemployment rate."

whether financial markets play an important role in the propagation of nonfinancial market shocks, and whether or how policy reacts to financial market shocks have become more important and timely.

This paper identifies a new shock that originates in the financial sector and accounts for a significant portion of

business cycle fluctuations. Christiano, Motto, and Rostagno construct and estimate a standard monetary DSGE model to include financial markets, and fit the model to European Union and U.S. data. The authors argue that traditional models assume that interest rates on loans are nominally non-state-contingent, which is problematic, and show that the distributional consequences of this nominal rigidity play an important role in the propagation of shocks. They conduct a detailed study of the role of this shock in the boom-bust of the late 1990s and early 2000s. The empirical results draw attention to this new shock and to an important new nominal rigidity. Finally, the authors exploit the existence of financial variables in their model to investigate the consequences of adopting a monetary policy that reacts to the stock market or to a broad monetary aggregate.

The authors' model is effectively one of net financial flows between sectors. They consider various monetary aggregates, various interest rates, a measure of the external finance premium, and the value of the stock market, in addition to the standard macroeconomic aggregates. A key finding suggests that models without financial factors cannot explain simultaneous booms in investment and stock markets; standard models ignore the stock market and explain an investment boom with shocks to marginal efficiency of investment, but these shocks imply counterfactual behavior of the stock market. The model shows that financial shocks affect demand for capital. It can therefore get the investment-stock market correlation right. Shocks to risk-taking behavior by entrepreneurs and especially news about this shock play a particularly important role in European and U.S. business cycles.

The authors also find that the Fisher debt-deflation channel amplifies the effects of shocks that drive output and the price level in the same direction and buffers the effects of shocks that drive output and the price level in opposite directions.

During the discussion, participants agreed that the paper can make central banks pay attention to optimizing models as tools for real-world policymaking. One participant commented that the household sector in this paper is the net lender, so household balance sheets do not matter in the model, which is difficult to reconcile with recent experience. One way to deal with this, as discussant Rhys Mendes suggested, is to adopt different discount rates to get household borrowing with limited heterogeneity. Another participant mentioned that bank capital in the research setup has no role, which would likely create a role for the banking sector in propagation.

Banks, Market Organization, and Macroeconomic Performance: An Agent-Based Computational Analysis

Peter Howitt, Quamrul Ashraf, and Boris Gershman

A key question in financial friction models is the role that banks play. Banks and other financial intermediaries play a critical role in an economy's trading network, not just because they themselves are part of the network, intermediating between surplus and deficit units, but also because their lending activities influence the entry and exit of other intermediaries throughout the network.

This paper investigates the role of banking in stabilizing the economy and damping shocks, and explores a model that portrays this role of banks in the mechanism of exchange and its prediction on the extent that banks influence the economy's macroeconomic performance. The paper builds an agent-based computation analysis instead of using a rational expectations approach. Howitt, Ashraf, and Gershman consider a model economy in which a self-organizing network of entrepreneurial trading firms facilitate and coordinate exchange activities. The idea motivating their approach is that complex systems, like

“These problems of moral hazard originate from the temptation entrepreneurs face when undertaking projects that have a lower probability of success but higher private benefits.”

economies or anthills, can exhibit behavioral patterns beyond what any of the individual agents in the system can comprehend.

So instead of modeling the system as if everyone's actions and beliefs were coordinated in advance with everyone else's, the model assumes that people follow simple rules, and their interaction might or might not lead the system to approximate a coordinated equilibrium. By using intensive computational algorithms and running experiments, the authors find that solid, prudent banks are a good thing for the economy at the median. Making those banks “risky” does remarkably little to create median economic performance but strong non-linearities manifest themselves in a small proportion of bank runs. In addition, the authors raise the concern that the banking industry itself could be a source of problems.

The authors' analysis suggests that banks normally improve macroeconomic performance, but when the economy is experiencing particularly bad times, banks make the situation even worse. Their results suggest two kinds of regulatory changes that might improve macro performance in bad times: 1) restricting loan-to-value ratios and 2) restricting bank dividends. During the discussion, one participant commented that this paper is ambitious and promising because it uses agent-based computational economics (ACE). ACE has attractive features over DSGE models. The discussant Robert Tetlow noted that in an ACE-type of model, agents are hetero-geneous and all shocks are individual. Agents are bounded rational and follow simple rules, but it would be helpful to adopt a thorough calibration of the model. Another participant expressed his concern that it is difficult to tell which model features matter and that the model is not up to the task for some experiments such as the bank bailout. Participants also commented on the predictive accuracy of the model since bubbles are always preceded by either a technical innovation or a regulatory change. Some other suggestions such as introducing exogenous population or productivity growth were also made.

Modeling Monetary Policy

Andreas Schabert and Samuel Reynard

In the last few decades, monetary policy has been viewed mainly as the science of controlling short-term interest rates and keeping inflation expectations in line with central bank targets. However, the current financial crisis has shifted attention to the central banks' supply of money and its role in financial crises. To address this issue, Schabert and Reynard developed a macroeconomic framework that models monetary policy implementation in a way that accounts for three facts that standard macroeconomic models typically neglect. First, the asset market is separate from the money market, and the central bank supplies money in exchange for assets. Second, not all default-risk-free assets are eligible in open market operations, giving rise to a liquidity premium on eligible assets compared to privately issued debt. Third, the central bank just transfers interest earnings from holding interest-bearing assets, leading to a nondegenerate distribution of liquid assets.

This paper is motivated by three factors. One of these is the substantial time series variation in the difference between the fed funds rate and the measured stochastic discount factor (SDF). Another is the point that New Keynesian models identify the one-period return of a unit discount bond with the central bank policy rate. The third factor is

that central banks manage the relative price of the transaction values of short-term assets to central bank liabilities. This paper uses friction of intraperiod market segmentation to create a spread between the central bank policy or repo rate, the return on one-period government bonds, and the SDF. The authors base their model on some important assumptions that differ from a standard macroeconomic model. They assume that financial markets are separated. The asset market, where agents trade interest-bearing assets and cash, opens at the end of each period. The authors also assume that only short-term government bonds are eligible in open market operations, while other, especially privately issued debt securities, cannot be cashed in at the central bank. Finally, they assume that central banks reinvest payoffs from maturing securities in new assets. As a consequence, the distribution of eligible securities between the private sector and the central bank changes over time and, in particular, varies with the monetary policy stance. This property exerts an additional effect of monetary policy on private-sector behavior—specifically, a hump-shaped consumption response to monetary policy shocks.

Seminar participants discussed how the paper could potentially employ time series tests to describe statistical joint behavior of fed funds, T-bill, and SDF rates. Participants also talked about existing work that models interbank funds markets. Discussant Jim Nason asked whether it matters if the fiscal policy rule is state-contingent. He suggested that to answer this question, the authors try rules that equate the tax rate to debt-output ratios plus a government spending and fiscal policy shock. Another participant suggested extending the analysis to long-term government bonds and physical capital instead of restricting households to holding only one-period government bonds and cash.

The Role of Bank Capital in the Propagation of Shocks

Cesaire Meh and Kevin Moran

Meh and Moran propose a DSGE model with a financial accelerator, a bank capital channel, and nominal rigidities. This model emphasizes the role of bank capital in the transmission of shocks. Bank capital is important in the model because it mitigates moral hazard between banks and the investors who supply loanable funds. As a result, the capital position of banks affects their ability to attract loanable funds and to lend, and therefore influences macroeconomic fluctuations. The authors show that the presence of a bank capital channel of transmission amplifies and propagates the effects of technology shocks on output, investment,

and inflation but has a more limited role in the effects of monetary policy shocks. One key aspect of the framework is that it generates movements in bank capital adequacy ratios that co-vary negatively with the cycle.

There are two kinds of frictions in the economy: moral hazard on the part of entrepreneurs and moral hazard on the part of bankers. These problems of moral hazard originate from the temptation entrepreneurs face when undertaking projects that have a lower probability of success but higher private benefits. Bankers must therefore incentivize these entrepreneurs to pick the right project by offering enough net worth—that is, a project should have a financial accelerator. In the model, investors lack the ability to monitor the economy's entrepreneurs and thus do not lend directly. Instead, they deposit funds at banks, to whom they delegate the task of monitoring entrepreneurs. However, banks may not monitor adequately, since doing so is costly and not publicly observable, and any resulting risk in their loan portfolio would be borne mostly by investors. The authors show that when the bank capital channel is active, an economy with more bank capital is better able to absorb negative shocks than an economy with less bank capital.

During the seminar, discussant Skander Van Den Heuvel expressed his concern about the term bank capital in the model. He suggested that the concept defined this way might have ambiguity because people do not know whether it refers to inside equity or tangibles. Another discussant commented on regulatory capital requirements that the paper does not address. He mentioned that the dynamics of the bank capital channel are broadly similar for a regulatory requirement. Hence, the buffer of excess capital is an important state variable. Another participant suggested the paper allow movements in capital-asset ratios to reflect both the influence of regulatory requirements and market discipline. Adding explicit regulatory requirements into the framework, he said, will enrich the analysis and possibly affect the business cycle properties of capital adequacy ratios. The authors agreed that other potential extensions include introducing bank-level heterogeneity in the model and then studying its resulting influence on aggregate bank lending

Financial Structure and the Impact of Monetary Policy on Property Prices

Katrin Assenmacher-Wesche and Stefan Gerlach

This paper is motivated by beliefs that asset prices—in particular, residential property prices—provide a crucial

link through which adverse macroeconomic developments can cause financial instability. In addition to being a significant source of volatility, property prices are an important channel in the transmission of monetary policy to the real economy. For many households, residential property accounts for a large share of wealth, so changes in property prices can be expected to impact consumption and GDP. However, it is unclear whether monetary policy has predictable effects on property prices, whether these effects are large relative to the effects on inflation and economic activity, and whether they materialize faster than do the effects on inflation and economic

“During the discussion, a participant noted that net worth shocks in this paper are more powerful than standard total factor productivity (TFP) shocks, and they cause the risk premium to fluctuate even with log utility.”

activity. To address whether central banks can identify the timing when asset prices move too fast or are too high, Katrin and Gerlach examine the impact of monetary policy shocks on inflation, output, credit, and residential property prices. They find that monetary policy could slow property price booms but at the cost of a considerably weakened real GDP.

To shed light on the impact of monetary policy on residential-property prices, credit, inflation and output growth, the authors establish empirical regularities, as captured by the impulse-response functions of vector-autoregressive models (VARs). An important feature leading the authors to use this panel VARs approach is that it allows them to look at a broad cross-section of countries that experienced property price movements of varying severity and at varying points in time and thereby avoid the bias that comes from looking mainly at countries that have undergone particularly pronounced property-price cycles. To perform the analysis, the authors studied a panel of 18 OECD countries, using quarterly data for the period 1986–2008. Their results show that while monetary policy does have important effects on residential-property prices, those effects are not particularly large relative to those it has on inflation and output. This finding suggests that attempts to stabilize property prices by using interest rate policy are likely to induce

pronounced macroeconomic fluctuations.

During the seminar, discussant Sharon Kozicki suggested the paper use variance decompositions to analyze the importance of each shock driving historical property price variation. A participant expressed concern about the international issues because foreign ownership of property as an investment (e.g. through REITs) could open the door to global liquidity as a driver of property price movements. Under this circumstance, domestic monetary policy may not be effective at stabilizing property prices. Assenmacher-Wesche agreed that the appropriate policy tool may depend on what drives the fluctuations. Another participant asked whether VARs are capturing periods of financial instability because there may be a nonlinear relationship between property prices and other macroeconomic variables. Future extension of the work, as Assenmacher-Wesche suggested, will be on the transmission mechanism of monetary policy and the role of property prices.

Macroeconomic Effects of Financial Shocks

Vincenzo Quadrini and Urban Jermann

Starting from an empirical observation that shows financial flows in the nonfarm business sector as a percentage of quarterly GDP, Quadrini and Jermann extend an RBC model with financial frictions and credit shocks. The motivation comes from recent economic events starting with the subprime crisis in the summer of 2007, which suggests that the financial sector played an important role in the transmission of and as a source of business cycles. The authors suggest that although macroeconomics has a long tradition of considering financial accelerators, quantitative model building has not focused much on matching simultaneously real aggregates and aggregate flows related to debt and equity financing. While standard productivity shocks can only partially explain the observed variations in real variables and financial flows, this paper shows that financial shocks that affect firms' capacity to borrow can bring the model much closer to the data. Specifically, the model implies that the economic downturns in 1990 and 2001 were strongly influenced by changes in credit conditions.

The model has explicit roles for debt and equity financing and has its business cycle implications. Quadrini and Jermann document the cyclical properties of firms' equity and debt flows at an aggregate level. They then build a business cycle model with explicit roles for firms' debt and equity financing. They show that the model driven solely by measured productivity shocks fails to match business cycle volatilities and the behavior of equity and debt flows.

Augmenting the model with credit shocks that directly affect firms' ability to borrow brings the model much closer to the data not only for financial flows but also for some of the real business cycle quantities. Another important contribution is that the authors construct series for productivity and credit shocks from the data using the model's restrictions. In addition, they evaluate the importance of credit shocks and productivity shocks on macroeconomic fluctuations. Finally, they highlight the fact that in order to capture the key empirical properties of financial flows, we need credit shocks.

During the seminar, discussant Pedro Amaral commented on the modeling of limited enforcement. He noted that the amount of intermediation is a crucial quantity in mapping limited enforcement models to the data. Another participant suggested the model relax the assumption of the cost imposed on dividend adjustment. Someone else noted that the equity value of the firm is countercyclical in the model, and this is not a good model of the stock market but is a good model of flows. Quadrini responded that because of the difficulty with productivity shocks in replicating key macroeconomic variables, financial frictions such as shocks to firms' borrowing ability and rigidities of financial structure are important for macroeconomic fluctuations.

Optimal Monetary Policy in a Model with Agency Costs

Charles T. Carlstrom, Timothy S. Fuerst, and Matthias Paustian

This paper studies optimal monetary policy in a model with financial market frictions. Given the importance of the role of financial shocks in the business cycle, this paper integrates a model of agency costs into an otherwise standard Dynamic New Keynesian (DNK) model. The authors do so in such a way that the agency-cost mechanism is quite transparent, and interactions between sticky prices and agency cost distortions are clearly identified. Agency costs are modeled as a constraint on the firm's hiring of labor as in the hold-up problem.

Financial shocks are modeled as shocks to the net worth of entrepreneurs, and they act like endogenous markup shocks. Net worth shocks imply that inflation stabilization comes at the cost of increased fluctuations in the output gap and in the tightness of the collateral constraint that enter the loss function. Eventually, the authors derive analytical expressions for the model-consistent welfare function.

In their setup, asset prices affect the value of net worth, money is non-neutral because of sticky prices, and monetary policy affects aggregate demand and asset prices. Agency costs act as endogenous mark-up shocks, and they magnify the welfare costs of all shocks, regardless of monetary policy. The authors assume that the entrepreneur's hiring of one productive factor (labor) is constrained by entrepreneurial net worth. More generally, the constraint proxies for the effect that asset prices have on the ability of firms to finance operations. Net worth is accumulated over time via purchases of shares that are claims on the profit flow of sticky-price firms that produce the final good. This leads to a natural interplay between price stickiness and collateral constraints. The paper also fully characterizes optimal monetary policy and provides conditions under which zero inflation is the optimal policy.

During the discussion, a participant noted that net worth shocks in this paper are more powerful than standard total factor productivity (TFP) shocks, and they cause the risk premium to fluctuate even with log utility. Another participant commented that the findings are complementary to previous work in that the standard agency-cost model predicts very small fluctuations in borrowers' leverage ratios while the authors find that nonfinancial firms' standard deviation of leverage ranges from 20 percent to 30 percent, which is very volatile. Participants also asked how monetary policy should be conducted in such an environment. Carlstrom responded that by deriving a quadratic welfare function that is consistent with the underlying model, the authors can analyze optimal monetary policy in a linear-quadratic framework.

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Lawrence J. Christiano, Mathias Trabandt, and Karl Walentin

CQER Working Paper 10-04 (August)

The authors extend the standard new Keynesian model by incorporating financial frictions in capital accumulation and management, modeling the labor market using a search and matching framework, and extending the model into a small open economy setting.

Involuntary Unemployment and the Business Cycle

Lawrence J. Christiano, Mathias Trabandt, and Karl Walentin

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When the authors integrate their model of involuntary unemployment into a DSGE model, the resulting model does well at accounting for standard macroeconomic variables' response to monetary policy shocks and two technology shocks.

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Lawrence J. Christiano, Martin Eichenbaum, and Sergio Rebelo

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