

# Connecting Policy with Frontier Research

Oct. 15-16, 2015

Economist Interviews from the 40th Annual Federal Reserve Bank of St. Louis Fall Conference



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# Table of Contents

- 4 Message from the President**  
James Bullard  
*President and CEO, Federal Reserve Bank of St. Louis*
- 5 Message from the Research Director**  
Christopher J. Waller  
*Senior Vice President and Research Director, Federal Reserve Bank of St. Louis*
- 6 Foreword from the Conference Organizers**  
Paulina Restrepo-Echavarria and Guillaume Vandenbroucke  
*Federal Reserve Bank of St. Louis*
- 9 Conference Volume Description**
- 10 “Analyzing the Effects of Insuring Health Risks: On the Trade-Off between Short-Run Insurance Benefits and Long-Run Incentive Costs”**  
Interview with Harold Cole  
*University of Pennsylvania*
- 15 “The Safety Trap”**  
Interview with Emmanuel Farhi  
*Harvard University*
- 20 “Use It or Lose It: Efficiency Gains from Wealth Taxation”**  
Interview with Fatih Guvenen  
*University of Minnesota*
- 24 “The Aggregate Implications of Regional Business Cycles”**  
Interview with Erik Hurst  
*The University of Chicago*
- 28 “The Chinese Savings Rate: Productivity, Old-Age Support and Demographics”**  
Interview with Ayse Imrohoroglu  
*University of Southern California*
- 31 “Wholesale Banking and Bank Runs in Macroeconomic Modeling of Financial Crises”**  
Interview with Nobuhiro Kiyotaki  
*Princeton University*
- 35 “Intangible Capital and Measured Productivity”**  
Interview with Ellen McGrattan  
*University of Minnesota*
- 40 “Neoclassical Models of Aggregate Economies”**  
Interview with Lee Ohanian  
*University of California, Los Angeles*
- 45 “Monetary Policy with 100% Reserve Banking: An Exploration”**  
Interview with Edward Prescott  
*Arizona State University*



## James Bullard

*President and CEO  
Federal Reserve Bank of St. Louis*

### Message from the President

At the Federal Reserve Bank of St. Louis, we have long tried to provide perspectives on whether the economic policies adopted in the past still serve us well today and whether recent developments at the frontier of research can be fruitfully applied to improve policy. This agenda has become especially important in the past few years, as the Federal Reserve and other central banks around the world have struggled to devise appropriate policy responses to the current macroeconomic situation.

In polite economist society, there has long been a distinction between what is known as “frontier” research and what is sometimes called “policy” research. In my view, this has been and continues to be a false dichotomy. There is no such distinction: “Policy” and “frontier” research are two sides of the same coin. We need to understand both how fundamental mechanisms in the economy operate as well as how current data and policy measures can be interpreted in terms of fundamental theory.

In short, advanced economic theory has to be made more relevant for actual policy, and actual policy has to understand and embrace the sometimes difficult ideas advanced in the theoretical literature. The St. Louis Fed has long been a leader in supporting research at the intersection of economic theory and economic policy.

At our 2015 fall conference, we were fortunate to have an outstanding group of speakers, whose research is sure to expand our understanding of key contemporary issues in macroeconomics. The conference agenda included papers on monetary policy, the Chinese savings rate and wealth taxation, among other topics. The St. Louis Fed was proud to provide this forum for discussion and analysis of the leading issues of the day.

In addition to finding ways to connect the research world with the policy world, the St. Louis Fed strives to connect academic research with a nonacademic audience. Our goal is to explain in lay terms why the research is important, what implications it has for policy and what it means for people and the economy overall.

This volume brings the main findings of the research presented during the conference to a wider audience. We hope that you find the material informative and that it will serve as a resource on important macroeconomic and policy issues.

**James Bullard**

President and CEO

Federal Reserve Bank of St. Louis



## Christopher J. Waller

*Director of Research  
Federal Reserve Bank of St. Louis*

### Message from the Research Director

The Research division of the Federal Reserve Bank of St. Louis has long been renowned for its cutting-edge research, policy analysis and provision of economic information to the public. This tradition dates back to the 1960s, when Homer Jones was the director of the Bank's Research division. At that time, the St. Louis Fed took a very contrarian stance on how monetary policy should be conducted and backed that stance with top-flight economic research.

We have found that the best policy advice comes from economists who work at the frontier of economic thinking. Academic economists are often vocal in their views about policy and are willing to critique actions taken by the Federal Open Market Committee, the main policymaking body of the Federal Reserve System. To evaluate arguments of academic critics and make use of good ideas and research for policy, the Fed must have economists who work at the frontier of knowledge. Fed economists must be able to explain their own views in a rigorous way, as well as explain why an alternative claim about policy is suspect. A healthy competition of ideas allows the best theories and policies to win in the end.

Academic research is valuable because the thinking about economic issues is unrestricted. It is proactive in that it often focuses on interesting issues long before they come to the attention of policymakers.

Academic research is rigorously vetted before publication in peer-reviewed journals. It is forged in the fires of debate and criticism. Academic research also takes the form of program evaluation (economic autopsies) of major economic events. It can take years to analyze and understand what happened and what policies or regulations need to be changed.

At the St. Louis Fed, we continually look for ways to connect frontier research with policy. Our annual conference, which brings together leading academics and economists, does just that. The discussions that follow highlight some of the key contributions of the papers presented at the 2015 fall conference.

#### **Christopher J. Waller**

Executive Vice President and Director of Research  
Federal Reserve Bank of St. Louis



## Paulina Restrepo-Echavarria

*Economist*

*Federal Reserve Bank of St. Louis*

### Foreword from the Conference Organizers

Every year, two economists from the Research division of the Federal Reserve Bank of St. Louis organize the Bank's annual research conference. The privilege was ours for the 40th Annual Federal Reserve Bank of St. Louis Fall Conference. Of course, a conference of this magnitude doesn't come about through the work of only two people. We are grateful for the numerous Bank employees who worked to make this conference happen.

The rich tradition of this conference began when the first one was held on Nov. 30, 1976. It was titled "Financing Economic Growth: The Problem of Capital Formation," and considered the problems of generating sufficient flows of saving and investment to finance economic growth and development in the future.

Since then, the annual conference has continued to feature the latest in policy and frontier research. This year's conference was highlighted by yet another distinguished group of speakers. Specifically, this year's speakers presented papers:

- Examining the extent to which recent developments in neoclassical models can improve our understanding of aggregate economies
- Incorporating intangible investments into a multi-sector general equilibrium model to estimate processes for latent sectorial total factor productivity
- Discussing the role of wholesale banking and bank runs in modeling financial crises
- Seeking to understand the behavior of the Chinese savings rate, which has more than doubled since 1980



## Guillaume Vandembroucke

*Senior Economist*

*Federal Reserve Bank of St. Louis*

- Studying the determinants of prices, wages and employment during the Great Recession using regional business cycle data
- Exploring monetary policy when fractional reserves are set at 100 percent
- Studying the macroeconomic effects of a shortage of safe assets and the emergence of a deflationary equilibrium
- Examining the quantitative implications of wealth taxation through an incomplete markets model where individual rates of return are heterogeneous
- Discussing a dynamic model of health insurance used to evaluate both the short- and long-run effects of policies that prevent firms from conditioning wages on the health conditions of their workers

One of the St. Louis Fed's goals is to make economic data and research available to a broad audience. This conference volume, in which our speakers describe their work in layman's terms, follows in that tradition.

We thank you for your interest in the 2015 conference and look forward to next year's conference.

### **Paulina Restrepo-Echavarria**

Economist

Federal Reserve Bank of St. Louis

### **Guillaume Vandembroucke**

Senior Economist

Federal Reserve Bank of St. Louis

# Interviews

ME 1 Preview

CAM1

CAM2

CAM3

Slide Deck

SuperSource

Media Player 1

SAMSUNG

Home Menu

R/E 1

RTN 2 R/E Production Switcher  
R/E 1 R/E 2

System Control





## David Andolfatto

*Vice President and Economist  
Federal Reserve Bank of St. Louis*

### 40th Annual Fall Conference

The Federal Reserve Bank of St. Louis hosted its 40th Annual Fall Conference on Oct. 15-16, 2015. David Andolfatto, a vice president and economist at the St. Louis Fed, sat down with each of the conference presenters and discussed their work in plain English. The content in this conference volume is based on those interviews. All interviews have been edited for clarity and length.

For the full conference agenda, please see [http://research.stlouisfed.org/conferences/Fall\\_Conference/program](http://research.stlouisfed.org/conferences/Fall_Conference/program).

*The views expressed in this volume are those of the individuals presenting them and do not necessarily reflect the views of the Federal Reserve Bank of St. Louis or the Federal Reserve System.*



## Harold Cole

*University of Pennsylvania*

“Analyzing the Effects of Insuring Health Risks: On the Trade-Off between Short-Run Insurance Benefits and Long-Run Incentive Costs”

**David Andolfatto:** What’s the basic idea behind this paper? What question are you asking here?

**Hal Cole:** First of all, we were interested in to what extent health translates into either income or medical expenditures. To what extent do you face health risks? We were really primarily concerned about the years between when you start work and you finish work at retirement, thinking: “Is that big, and to what extent those risks are controllable by your own behavior?”

We all read about the obesity epidemic and various other things, the increased onset of diabetes. And, truth be told, the things we get interested in are motivated by our own life experiences. I have young kids, and I’ve had to deal with doing sports with them. I found myself back in the gym working out, thinking I’ve got to survive until pretty late out there.

So I was thinking about how much I was working to try and affect my health, and about the kind of risks and trade-offs that people face and the extent to which people can or are not incentivized to do something about things.

**Andolfatto:** Your paper is specifically about examining the likely incentive effects of different certain legislations concerning health care. Can you describe what specific legislation you’re interested in and your interest in what potential effects it has on the incentives for people to lead more or less healthy lifestyles?

**Cole:** One of the things that struck me was to what extent employers are being forced to basically eat the health-related costs associated with their employees. I started thinking about to what extent that then feeds back on the incentives of employees to take care of themselves.

I started thinking about it also in terms of Obamacare. Yes, we’re going to be insuring a lot of people against their health-related things, and insurance obviously has big positive benefits. But at the same time, it might be affecting the degree to which they had an incentive to be more careful and take care of themselves.

**Andolfatto:** Oftentimes as researchers when we approach questions—it’s been my experience and I’m sure yours as well—we’re motivated by things we actually see out there. Do you see examples of how people have modified their behavior in light of being insured in general or specifically owing to this legislation?

**Cole:** A lot of it is somewhat internal, which is that I certainly see myself responding, as I was suggesting, to the incentives and to the need to go out there and still be able to beat my kids in soccer and various other things. I see myself responding, so I assume that others, probably to a fair extent, will do so as well.

One of the big things we were trying to do was think about how you would model these policies. What’s a nice environment in which to model these policies? Then we try and think about how you would take such a model to data.

A number of things came out that I thought were interesting. For example, we have a stylized version of Obamacare.

In the data, we have data on health status. So we’re going to treat that as your pre-existing condition: If you have excellent health, that’s your pre-existing condition. If you have the lowest—fair health, which is actually poor—that would be your pre-existing condition. And then the question is, “What kind of program would you have to put in place to prevent an insurance company from trying to price discriminate across the various groups?”

What impressed us was the extent to which you had to intervene. You could see that in the model, which is the extent to which you had to try and stop these guys from structuring the benefits—you know, what we would pay for—to try and prevent you from cherry picking.

**Andolfatto:** Give me an example of that.

**Cole:** Let’s think about the price/expenditure trade-off. If you have someone who has very low risk of some of these things, then if I take that out of the mix, that’s not going to bother

them very much. If you have someone else who thinks they face a much higher risk of those kinds of expenditures, then you might take ...

**Andolfatto:** Young versus old, for example?

**Cole:** Young versus old, but also the idea that people report things about their health status. They report in these surveys that we use, and what you find is they're fairly predictive in the sense that people who report good health status or excellent health status have significantly lower medical expenditures during that ensuing six years than people who report poor or fair.

**Andolfatto:** Do you have, in your data, measures of how much time people allocate to maintaining their health?

**Cole:** What we have is one panel dataset called the PSID, Population Survey of Income Dynamics. That follows people, and we have a bunch of data in there.

But in terms of effort-related stuff, we have two measures of exercise: light and heavy. Light covers things like even housework and gardening. It really is a nice, general measure of walking, stepping, doing any kind of thing. Heavy exercise is what it sounds like. And then, also, there's smoking. So these are fairly limited measures.

We need that in addition to measures of income, because we were trying to use that to think: "OK, what is the connection between the effort you're exerting and your income?" Then we also use that to think: "What is your health status today? What is your effort today? And what is your health status tomorrow?"

**Andolfatto:** You mentioned that the paper constructs a dynamic model of health insurance to evaluate the short- and long-run effects of policies that prevent firms from conditioning wages on health conditions of their workers and that prevent health insurance companies from charging individuals with adverse health conditions higher insurance premium. That's what you are specifically interested in?

**Cole:** Yes. There are two big policy interventions. One, where I think we really closely capture it, is Obamacare. They really are doing pretty much literally what we're suggesting. Then there's the Americans with Disabilities Act and its amendment.

And, basically, the act and the amendment are trying to limit the extent to which employers can discriminate against

workers with respect to hiring, firing, promotion and wages for any kind of health-related issues. Now, the extent to which they're constrained, there are limitations on that. It has to be somehow reasonable expense and reasonable accommodation, but my understanding is that it can be reasonably expensive, and you can have to make a fairly significant accommodation for someone.

**Andolfatto:** Let me step back a bit here and take a look at how you approach this question of evaluating these government interventions. You begin with a model, first of all, that's completely absent of government intervention. You model what you call a "competitive insurance market." By construction, this market does not work fully well. It provides some insurance, but there are frictions that prevent a fully idealized situation from occurring. And it's in the context of this model that you evaluate these two restrictions?

**Cole:** Yes. Let me say a little bit about what does that. Both the labor contracts and the insurance contracts are short term in the sense of, for whatever the period length, that's the length of the contract interval. So that limits a lot of the insurance. Also, what's true is those contracts are not conditioned on the effort you make to take care of yourself. That's an assumption we made.

**Andolfatto:** And that's an assumption that you think is a reasonably good approximation of the type of health policies we see out there?

**Cole:** Yes. When we go to the data, we're going to look at a period length as being six years. So the notion here is that any sort of reasonable amount of labor mobility—people moving across jobs and moving across insurance companies—would probably wipe out that kind of conditioning.

**Andolfatto:** And one property of your model is that after six years, the time length that a person is in a pre-existing condition, he has to become reinsured with a pre-existing condition?

**Cole:** Yes, that's right.

**Andolfatto:** Now, you consider two types of policies that prevent firms from conditioning wages on health conditions, because firms do this in your model, I presume.

Secondly, the restriction that prevents health insurance companies from charging individuals with adverse health

WHAT WE WERE INTERESTED IN DOING WAS THINKING: “IF WE GO ABOUT TRYING TO MODEL THE POLICIES CAREFULLY AND THEN QUANTIFY THE TRADE-OFF, HOW MUCH INSURANCE IS EFFICIENT?” THE ANSWER WE FOUND, WHICH SURPRISED ME, WAS THAT YOU DO WANT TO PROVIDE QUITE A BIT OF INSURANCE.

conditions higher premium. You study each of these interventions individually and then jointly. Tell me what happens here.

**Cole:** One of the things we were interested in is where the big health-related risks that people face are. It turns out the big chunk of it is actually with respect to income and wages, and it's not medical expenditures. So that's the more important risk that you face.

I'm going to throw out a rough number. If you go from the highest health status to the lowest health status, you're looking at something like a 30 percent drop in income, just in terms of the averages, conditioning on health status. That's a lot of risk.

One thing that's true with respect to the medical risk: We're looking at people between the ages of 24 and 60. If you think about medical expenditure risk, a lot of that is going to be after 60. So we are looking at a certain period. But conditioning on that, the big risk is earnings risk. And it looks like your health can have a significant impact on what your life cycle profile of earnings looks like. In many ways, it looks very reasonable.

We look at people's earning profiles if high school educated or less and then above high school. You see a fair amount of sensitivity in both. But it's more pronounced in the high school or less.

**Andolfatto:** Let's take one of these policies individually. Pick whichever one you want. You want to evaluate the effect that it has on the prime-aged population that you're looking at. Describe to me how in the model people behave in terms of their willingness to remain healthy, to do exercise, and how it impinges on their lifetime earnings profile. I presume they're made better off by the policy individually.

**Cole:** One of the things I found that was surprising when I started thinking about this is that I thought the incentive effects and the incentive costs would be very negative. So when we came at this, the vision we had was the incentive you have in terms of taking care of yourself doesn't help you this

week or this month, but over some longer horizon it's going to affect things.

The time unit here is six years, as I said. So the updating of your health status between this period and the next, we thought that you could actually significantly affect with health-related effort. That's supposed to cover a lot of things: diet, whether you brush your teeth, the whole gamut of things that you're supposed to be doing.

The vision we had was that people do that stuff for a reason, and the reason is to maintain themselves. People probably have an innate desire to maintain themselves. But you're also responding to the economic incentives. If we just think about professional athletes, they're exercising like crazy during the offseason so they can show up and still function.

The vision we had was that people were probably going to be reasonably sensitive to this. Then the question comes up. What happens is you put in policies that look very good in the short run in terms of providing a lot of insurance and filling holes that exist in the market as we saw it, but at the same time remove the future risks that were driving you to take care of yourself, and through that you have this longer-run incentive cost.

What we were interested in doing was thinking: “If we go about trying to model the policies carefully and then quantify the trade-off, how much insurance is efficient?” The answer we found, which surprised me, was that you do want to provide quite a bit of insurance. We looked at the socially efficient level, given that you face the same incentive problem as the market, that you can't control people's effort to maintain themselves. You end up still wanting to provide a lot of insurance to them, say, roughly 85 percent of their health insurance risk.

**Andolfatto:** One question I wanted to know: Are people healthier with this intervention or without it?

**Cole:** They're definitely less healthy.

**Andolfatto:** That's kind of provocative. The statement is that this type of intervention actually promotes overall welfare through the insurance effect, but it seems to have these predictive adverse consequences in how people maintain themselves over their life cycle.

**Cole:** That's completely correct. Now, it is, one could argue, a little bit built in by assumption. Let me explain what I mean by that.

We're thinking about insuring you against within-period health risks. The impact of these health risks, the way we model them, lowers your productivity within the period. So your health status comes in as a factor that's going to affect your likelihood of getting a negative shock within the period.

Then you go into the next period, and it's only the health status that you have in the next period that's going to affect your productivity. There was a reason for that, which is that the updating of your health status only depends on your effort, and it didn't depend on medical expenditures that were made on you.

The reason why is, when we looked at the data, certain things cried out. If you look at health status, does it affect earnings? Yes. If you look at health status, does it affect medical expenditures? Yes. If we looked at medical expenditures within the period, how does that affect updating? The effect was extremely weak and, if anything, negative.

Now you might think that there's a reason why people are getting those medical expenditures. But at least at the first rough pass looking at the data, you did not see that as a first-order piece of business. So we dropped that in terms of assuming that that was irrelevant to the updating.

**Andolfatto:** In the model, how are these programs financed?

**Cole:** The way in which we financed, for example, our version of Obamacare was that we simply had actuarially fair insurance that everyone had to pay, the common premium. Basically, the program was self-financing. When we do the no-wage-discrimination in the theoretical section, what we looked at was just compressing everyone to some sort of health-, education-, age-related average wage.

We thought any attempt to really force the pattern of who works for what at what wage, that would have significant cost. So we explored putting a little bit of costs in.

What we found in general was that it's very easy to rationalize putting in Obamacare as a welfare-improving program. The wage readjustment means that you don't really like the no-wage-discrimination policy. You prefer Obamacare. And that comes out as the policy recommendation in the paper. But what you don't want to do is insure people against all of their health-related risks. You want to leave them with some incentives to take care of themselves.

**Andolfatto:** You mentioned that you consider the welfare benefits and the incentive effects of each of these programs individually, and you find that, individually on net, people

would prefer these programs relative to your benchmark. But, jointly, that's not the case. And what is the reason for that?

**Cole:** First of all, there's a lot of risk that people face. But one of the things we do, which is kind of cool, is we can follow people and we can ask people: "How do you feel based on your health status? And how do you feel when you're young based on your health status as opposed to when you're old based on your health status?"

**Andolfatto:** When do you ask them?

**Cole:** We could ask them in the model. What's kind of cool about that is, as you get out there, your health risks are shrinking as you go out, because whatever you're going to get, you've got. For example, if we've got someone, say, our age and in excellent health, you really are against these programs. You like the competitive program, because basically in any version of these programs, you're going to be subsidizing the people with less health risk. And the insurance benefit to you is small, because the window left in our setup to get a negative draw is shrinking.

So you're very open when young to these insurance programs, and then as you go forward, depending on where you are, your attitudes sort of diverge. If you get a bad outcome, you're very much for the program. And if you get a good outcome, you become increasingly hostile to the program.

**Andolfatto:** That sounds perfectly natural. We change our minds all the time as we age, right?

**Cole:** Exactly. But it does explain some of the voting patterns out there if you think about it that way.

**Andolfatto:** Hypothetically speaking, in your model, if the government were to propose the joint provision in these two programs, I presume that it would be voted down.

**Cole:** Yeah, especially if you think that the older people vote more than younger people.

**Andolfatto:** And older here is still under 60.

**Cole:** Absolutely. The model doesn't go beyond 60, that's correct. So I thought there was an interesting political economy dynamic there.

**Andolfatto:** You mentioned that one thing that surprised you was you found potentially large welfare gains from the provision of these programs. But I noticed one property of your model—a simple, basic framework to start with—is that you do not permit people to save. There’s no financial market. For some purposes, that would be an appropriate abstraction.

In this case, I wonder how sensitive the welfare effects would be. If people had the ability to build precautionary savings as a substitute for the missing insurance, do you think it might be worthwhile to pursue this investigation along those lines? Or do you have some reason to believe it’s not important?

**Cole:** I think your instinct is exactly right. If I was to say what’s really missing from this model, I think that would probably be first on the punch list. When you write down a model and you try and construct its implications and take it to data, there’s a real desire to hold down the number of moving parts and to add moving parts slowly. The reason is that you want to have some idea of what’s really going on, what’s driving your results, what are the implications of your model.

Having savings I think is the next step. And I think it’s important exactly for the reasons you said. We chose deliberately to leave it out, because what it meant was that we could have this one period or static version of the model, and then when we go to the dynamics, you just have to worry about the dynamic incentive to maintain your health.

So you get a nice, simple characterization of how you’d want to do that. And it allowed you a nice, clean way to go after the data. We didn’t have to worry about the amount of savings that people had when we thought about effort and updating and all those kinds of things. But that it allowed for a lot of transparency, which is a good thing in terms of what we’re doing.

#### **The paper’s main takeaways, according to Cole:**

- In writing down an explicit model, we saw exactly where the frictions were that drove the regulation in various ways and, in particular, the need to try and regulate the form of the insurance policy and to mandate participation.
- Thinking seriously about the ability of people to control their health and the impact of their health on both their income and their expenditures seems like an important component of thinking about what we should be trying to get people to do, whether we should have programs to try and push more of that effort on their part.

To watch the interviews from the conference, visit <https://www.stlouisfed.org/connecting-policy-with-frontier-research/2015>.



## Emmanuel Farhi

*Harvard University*

### “The Safety Trap”

**David Andolfatto:** What is a safety trap?

**Emmanuel Farhi:** We chose that title, “The Safety Trap,” because it’s related to a liquidity trap. A liquidity trap is a situation where there’s a lot of demand for assets and there’s a shortage of assets in general, so much so that the price of assets goes up, which means that the interest rate goes down. But the interest rate can’t go below zero, because there’s money and bonds would be dominant of the money if the interest rate were to go negative.

**Andolfatto:** You say there’s a shortage of assets, but a particular type of assets, right? Not like a shortage of General Motors shares?

**Farhi:** That’s right. A liquidity trap doesn’t make a distinction between different forms of assets. They will have the same expected return. The perspective that we try to bring in is that the situation that I think we’re in now is a shortage of a very specific kind of asset—safe assets—and not a shortage of assets in general. So it’s a different form of asset shortage that brings you to a similar situation: the zero lower bound.

What we try to explain in the paper is that the fact that it’s a very specific form of asset shortage, and an asset shortage in general, makes a very important difference for the way you want to think about the situation and the way you want to think about policy, in particular, in this situation.

**Andolfatto:** What type of assets do you have in mind that are in such short supply?

**Farhi:** Safe assets, broadly speaking. By that, I mean essentially Treasuries. You could also think government bonds, safe government bonds. Or you could think about very highly rated tranches of securitization products, AAA-rated securities and things of that sort that would be backed by some form of real assets, eventually backed by land or some form of real estate, or by corporate assets.

**Andolfatto:** What does it mean to have a shortage of these assets? For example, there’s a shortage of highly skilled labor, and what we would expect is the price of highly skilled labor to reflect that shortage. Is that not the same case with a shortage of safe assets?

**Farhi:** It’s exactly the same thing, and actually there’s a way to view shortages of safe assets as a benign phenomenon. If there’s not enough safe assets, the price of safe assets is going to go up. If the shortage intensifies, the price will go up even further.

The problem is that when you’re at the zero lower bound, the piece that’s supposed to make this adjustment—the interest rate—cannot do the job. And so instead of having virtuous equilibrating mechanisms through decreasing interest rates, you’re going to have a perverse equilibrating mechanism that’s going to come into play through a reduction in output and a recession, which is going to bring back the safe asset market and equilibrium.

**Andolfatto:** In most cases, we would expect this asset shortage to be reflected, say, in the price of bonds or the bond yield. The scarcity should be reflected in the higher price for the security, a lower yield. But if at some point the yield is bounded below by zero or some lower bound, because the price mechanism is no longer able to equilibrate the market, the equilibration has to take place through another dimension?

**Farhi:** That’s exactly right. The market cannot equilibrate through prices, and instead it would equilibrate through quantities.

**Andolfatto:** But what are these safe assets doing that their shortages cause the output to fall below normal lines?

**Farhi:** What we have in mind is that people demand these assets for a variety of reasons. We actually don’t go too much in detail into these reasons. We assume that there are some

people who are extremely risk averse. So for either preference reasons, institutional mandates reasons or regulations reasons, they have a demand for these safe assets, even though these safe assets are not doing anything special. They just preserve value, and that's what these agents care about, either because of their preferences or because they're obligated to do that. That drives up the demand for the safe assets.

The fact that there is a lot of demand chasing a little pot of safe assets, that's what creates the problem.

**Andolfatto:** Suppose I'm a risk-averse agent, I want to hold a lot of bonds, and I'm out there bidding for these bonds. What is the idea, that I should be out buying shoes and restaurant meals, but instead I'm chasing government bonds?

**Farhi:** It's a market failure, which means that agents are doing the best they can from the prior perspective. It just ends up creating a problem at the level of the economy in general.

**Andolfatto:** What should they be doing if they're not buying these safe assets?

**Farhi:** They are. In the equilibrium, they are trying to buy them, and they're succeeding in buying them. They're satisfying their demand.

**Andolfatto:** How does this manifest itself as a reduction in output?

**Farhi:** The reduction in output takes place because you have nominal rigidities. That means that output is going to be demand determinant. It's a recession that's going to end up lowering the demand for safe assets, and that's an equilibrium phenomenon.

**Andolfatto:** Firms would like to produce more output, but they cannot?

**Farhi:** No. They would not like to produce more. They would like there to be more demand for their output. But there is none, and they cannot lower their prices to attract more demand because there are now more rigidities. Or maybe wages are rigid. That would have a very similar implication.

**Andolfatto:** So the zero lower bound problem. There have been a number of economists who have advocated that the Fed, or other banks in other jurisdictions, has done this to lower the nominal interest rate into negative territory. Would

those types of policies alleviate this problem?

**Farhi:** To the extent that it's possible. I think that's probably possible to lower interest rates a bit below zero. It would help. I do think that there's a limit to these policies.

**Andolfatto:** What is the question, the key question or the set of questions you're addressing in this paper? How are you building your theoretical setup to address this question?

**Farhi:** Just to recap: The model makes the point—and builds a structure that delivers—that a safe asset shortage can drive the interest rate all the way to zero. But it will not drive the expected return on every asset to zero. You already have risk premium, and that conforms with some of the recent evidence. You've seen that everybody has commented on the fact that there's been a secular decline in short- and long-term interest rates. At the outset in the recession, the interest rates quickly reached zero. But there's evidence that the equity premium has actually increased.

**Andolfatto:** Can you explain the risk premium and the equity premium?

**Farhi:** The idea is that risky assets compensate their holders for the risk that they're bearing by paying a higher return. If you look in the market, equities have a higher return than bonds. The question is: How big is the gap?

The fact seems to be emerging that this gap has widened. Even though interest rates have been going down—especially since the beginning of the recession—it's a trend that predates the recession. The rate of return on risky assets, like equities, has not gone down. So you've seen a divergence between these two things.

In my mind, this is the signature of the fact that the shortage of assets that we're seeing is not a shortage of assets in general, but a shortage of safe assets. Risky assets are not particularly expensive. Safe assets are very expensive.

Now we build this structure, and we explain how this situation can lead to a recession. It's something that could rationalize part of what's going on or what has been going on in the U.S. during the Great Recession.

Then we try to understand what policy could do. We already talked about one kind of policy, which would be trying to lower nominal interest rates below zero. And I think we could probably do some of that, but then we would reach some limits at some point because people would start substituting into cash.

We looked at other policies that have actually been deployed



during the Great Recession, and we tried to assess their performance in the model and compared their performance in the model to their perceived performance in the data. The kind of policies that we looked at were unconventional monetary policies.

One thing that works really well in this model is to increase the inflation target, because that allows you to run negative real interest rates—even though nominal interest rates are at zero—because you have inflation. So that would be a good idea in the model. If you can't do that, there are other things you can try to do.

Another dimension of unconventional monetary policy is what people call “forward guidance.” Forward guidance means you can't do anything with the current interest rates because those are already at zero, but you can try to promise to keep interest rates low in the future when the economy recovers. That's a policy that in typical models of liquidity traps works really, really well. It stimulates output and is very effective. Empirically, people have observed that the potency of this kind of policy might be much more limited. People are starting to term this phenomenon “the forward-guidance puzzle.” This is something that we can rationalize in our model.

In our model, if our explanation is correct, forward guidance is very ineffective in contrast to standard liquidity traps analysis. If you're in a safety trap where what drives the economy to the zero lower bound is a shortage of safe assets, forward guidance doesn't work very well. This is in sharp contrast to what happens in a liquidity trap where the economy reaches the zero lower bound because you have a shortage of assets in general, and where forward guidance works really well.

Another policy that we consider is quantitative easing. There have been several rounds of quantitative easing that have been implemented in the U.S., and we have some evidence as to their effects, even though it's very debated. So we have had different programs—QE1, QE2 and QE3—and we tried to understand how that would work in our environment.

It turns out that one thing that works really well in a safety trap is for the government to purchase risky assets and to issue safe assets. A version of QE like QE1 is something that will be very effective. The government would either issue reserves or issue other forms of safe short-term liabilities, and acquire private risky assets. By doing so, the government increases the supply of safe assets and stimulates the economy. So it's a theory of quantitative easing that could rationalize why these kinds of policies can be effective.

**Andolfatto:** Let's go back to the beginning in terms of what in your mind would be the driving force that would lead to such a shortage. Specifically, what sort of shocks might have led the economy to fall into the recession that we've recently seen? Or as you mentioned, there seems to be some sort of secular phenomenon at work here too. What is the driving force behind the shortage of safe assets?

**Farhi:** For the secular decline, people have mentioned different kinds of hypotheses. They go from the global savings glut to the accumulation of reserves by emerging markets to precautionary savings in the emerging markets. Some people have mentioned demographics. Some people have mentioned the decline of erratic prices of investment goods and things of that sort.

What I want to point out is that a lot of these explanations rationalize the decline in interest rates, but not necessarily the increase in the risk premium. That's a phenomenon that has to be driven, I think, by other things. And I think it's an important driver of the declining interest rate, one that shouldn't be neglected.

I think there are two things mechanically that can drive up this shortage of safe assets. It's demand or supply, to put it very simply. I think there's an element of both, especially if you think about what triggered the recent sharp decline in safe interest rates at the onset of the crisis.

I think there are some supply factors, so I think it's reasonable to have the following view: There are a lot of assets that people thought were safe, and they suddenly realized they were not so safe anymore. For example, you can think about some kind of assets backed by residential real estate and some tranches of securitizations of products that were sold and marketed as being very safe, and people perhaps perceived that they were really safe. In fact, it turned out that they were much more risky than people imagined. That could lead to a contraction in the supply of safe assets.

Another kind of asset that people thought was safe and turned out not to be so safe anymore is sovereign debt of a periphery country in Europe. These assets had very, very low yields, very low spreads compared to very safe countries before the crisis. These yields, these spreads exploded at some point during the crisis. So you have a contraction in the supply.

I think it's very natural to imagine that there's also an increase in the demand for safe assets at the onset of a recession like this one. People are just scared and afraid for a variety of reasons. And financial intermediaries are also hitting all kinds of regulatory constraints. That's going to drive up safe asset demand.

**Andolfatto:** I want to touch back on the very interesting subtle point you made. I've never heard of this apparent distinction between a liquidity trap and a safety trap. And the suggestion that the standard forward guidance kind of principle of [economist Michael] Woodford et al. works very well in a liquidity trap situation but not so much in a safety trap situation. Can you explain the distinguishing characteristic between a standard type of liquidity trap and what you are labeling here as a safety trap?

**Farhi:** I'm going to answer your question by first saying again that what distinguishes a safety trap and a liquidity trap is whether it's a shortage of safe assets specifically or assets in general. Now, how is that relevant for how forward guidance plays out and the effectiveness of forward guidance?

You can think of forward guidance in a very schematic form as follows in a typical liquidity trap. You're going to promise low interest rates in the future. That's going to stimulate consumption and demand today through a variety of channels. One of them is that it will increase the value of assets in the future, because interest rates will be lower. If you expect the value of assets to go up in the future, the value of assets will go up today. So forward guidance would boost the value of assets today, and it will stimulate spending and demand through a wealth effect. People who are richer spend more, and it stimulates the economy.

In a safety trap, this logic doesn't go through. Why? Because what you're trying to do is to increase the value of assets after the economy has recovered. And you will achieve that, so the value of assets after the economy recovers will be high. The question is whether it's going to increase the value of assets today. And what happens in a safety trap is that the effect is largely dissipated through an increase in risk premium today when you're in the safety trap, so the value of risky assets actually doesn't go up all that much. As a result, wealth doesn't go up all that much, and spending is not stimulated that much, so forward guidance loses some of its bite.

You can think about it in the following way. Forward guidance is a failed attempt at revaluing risky assets, and it's largely dissipated in high-risk premium. So it doesn't boost the value of risky assets all that much, and it's because it's trying to increase the supply of risky assets. That's not the problem in the safety trap. The problem is the supply of safe assets.

**Andolfatto:** Direct interventions or direct purchases of these risky assets—either through Federal Reserve balances or I suppose even the U.S. Treasury issuing safe bonds—either way, essentially a swap of private risky debt for safe public debt. These are the policies that seem to work?

**Farhi:** You could think about increasing the supply of safe assets through two kinds of policies along the lines that you suggested. The first one would be just to increase the level of public debt. We have all sorts of reasons to be worried about increases in public debt and to worry about fiscal sustainability and all of these things. I don't want to minimize them.

I want to point out that increasing the supply of public debt in a situation like this could also have beneficial effects—because it would increase the supply of safe assets—to the extent that it doesn't crowd out private safe assets. We have a way in the model of trying to think about how much crowd-out there's going to be in different regimes. And issuing debt or swapping debt for private risky assets will be more effective if there's less crowd-out. It's something that you can try to measure empirically: how much crowd-out there is.

**Andolfatto:** In terms of the other policy you mentioned—raising the inflation target—would that be, in your view or through the lens of your model, relatively less effective, less desirable or equivalent?

**Farhi:** In the model, that works really well, and it's a model that's not necessarily very good at thinking about all the costs of inflation, which I also think that collectively as economists we don't understand so well. So I don't want to comment too much on what would be the costs of increasing the inflation target. I do want to point out that there is a benefit in this model, which is that it would stimulate the economy.

**Andolfatto:** I'm a little surprised by that, because I think if we could just raise the inflation rate, we'll have the effect of lowering the real rate of interest, we'll have a negative real rate of return, and the economy is going to be really good. I don't normally associate negative real rates of interest with good, well-functioning, growing economies. Am I thinking about this the wrong way?

**Farhi:** I think there are two things. The first thing is: Suppose there are a variety of shocks driving the economy. So the interest rate is naturally going to go up and down. We would expect some correlation between interest rates and economic activity just from the shocks that are hitting the economy, not thinking about policy.

Then there's another question, which is: What is the effect of monetary policy? And do you believe that lowering the nominal interest rate is something that would stimulate the economy or contract the economy? The way some people think that

monetary policy operates is that when you lower the nominal interest rate, you end up lowering the real interest rate and that stimulates the economy. That's exactly what would happen if you had a higher inflation target in a safety trap. You lower the real interest rate, and you stimulate the economy.

**Andolfatto:** Prior to the lead-up to the crisis, we had several private-label products, AAA-rated tranches of mortgage-backed securities, serving as collateral in repo markets. Like you mentioned, people were perceiving these objects to be relatively safe. Suddenly, this perception seemed to have evaporated.

In your model, I think you also deal with the issue of the private provision of these assets, what motivates people to create these assets, what limits their ability to do so, and whether there's any reason to believe the private sector could be left to its own devices to produce these products. Can you tell us a little bit about the endogenous supply of these assets and what role there might be for government regulation of these products?

**Farhi:** That's a very good and important question. In the paper, we try to ask precisely this question, whether private agents would have the right incentives to create the safe assets, or whether, in our words, the private incentives to securitize will be aligned with social incentives to securitize. What we find is the following: In normal times, when you're away from the zero lower bound, you're not in a safety trap, private and social incentives are aligned, and there's no particular reason for the government to intervene in the securitization market. There's no market failure.

But when you're at the zero lower bound, when you're in a safety trap, there is a market failure. Private incentives are not aligned with social incentives in a very particular direction, which is the following: Agents are going to do too little securitization compared to what's socially optimal because they're not internalizing the micro-stabilization benefits of issuing more safe assets, which is in aggregate demand externally.

There's a role for the government to correct for this externality by encouraging the private supply of safe assets. And there's a way in which it relates to very concrete policies that governments implement in financial crisis, like helping financial institutions make sure that the securitization process can work effectively. This was the motivation that was given for a lot of these programs to restart the securitization market, and that was perceived to be very important.

**Andolfatto:** So what this paper does is outline guiding principles for a well-designed public policy.

**Farhi:** That's right.

**Andolfatto:** Downplaying certain types of incentives that different government agencies might have, I guess.

**Farhi:** Not downplaying them, but explaining what could be the benefits of certain government policies.

**Andolfatto:** If you had to make a recommendation to the Treasury or the Fed as to what the appropriate basket of risky assets would be to purchase, what would you recommend?

**Farhi:** I think you have to be very careful there because the independence of the Fed is a fragile construct that we need to be very aware of. But I think it's a question that people are asking actually in Europe right now. What kind of assets should they be purchasing? What kind of risky assets should they be purchasing? And they're considering expanding into much riskier private risky asset classes. It's something also that the Bank of Japan has done. They've even purchased equities.

**Andolfatto:** But this could be a Treasury operation. This is something that the Fed doesn't even have to do.

**Farhi:** Yes.

#### The paper's main takeaways, according to Farhi:

- If you look at a lot of big financial crises, like the Great Recession, they've been associated with a zero lower bound episode. Risk premia and returns of risky assets are not at the zero lower bound. Actually, they're relatively high, so that's an indication that we are more in a safety trap than in a standard liquidity trap.
- That perspective has very important implications for the way you think about how you're going to deal with that situation from the policy perspective. Increasing the inflation target is something that would work well. Doing forward guidance is something that would not work so well. And quantitative easing is something that would work relatively well.



## Fatih Guvenen

University of Minnesota

### “Use It or Lose It: Efficiency Gains from Wealth Taxation”

**David Andolfatto:** What do you mean by “use it or lose it” and wealth taxes?

**Fatih Guvenen:** If we just look at some broad numbers on how much the United States government is collecting in taxes on capital, the numbers are astounding. It’s about 8 percent of the GDP. At a gross domestic product of \$15 trillion, the total amount is \$1.2 trillion per year. Effectively, the government is taking this enormously large chunk of money and using it for various purposes.

Now, there’s a good reason why: We need this money, because there are government expenditures. But the sheer size tells us that we should be extremely careful in how actually we are taxing the different components of wealth. By that, I mean we are raising as the government a lot of money from capital gains taxation, from corporate income taxes, from taxes on dividends and from various other sources of capital. The main thesis of our paper is that there is a more efficient way of doing this.

The key idea is that we should be taxing the stock of wealth rather than the income that results from that wealth. As an example, imagine there are two investors with the same wealth, and one earns no return on this because he or she is not a great investor. And the second individual is a great investor who earns, say, 50 percent return per year on this wealth.

The current system is only taxing the successful individual and raising the funds from that individual alone. And because the first individual is not earning returns, we are not collecting any from that individual.

What we are proposing, rather, is to actually look at the wealth that you own and tax that stock. In this example, the first individual, even though he or she is not a great investor, has a lot of wealth. So we would be taxing the stock, reducing the wealth of the inefficient individuals.

**Andolfatto:** You point out that the taxation of capital income presently in the United States is large. How much of total tax revenue comes from capital income taxation?

**Guvenen:** It’s about 27 percent.

**Andolfatto:** So that’s a sizeable fraction of total tax revenue from capital income taxation. You’re not taking a stand on the size of that, but rather, what components of that wealth should be taxed. And you’re suggesting not to tax the income component, but more the stock or wealth.

But shouldn’t it be the case that the low-return guys should allocate their wealth perhaps through the banking sector to those that are better able to use it?

**Guvenen:** Some of that is happening. But imagine that you are a very high-return individual like Elon Musk. What are your incentives to share that high return with somebody who just has the money?

If you think about how the funds flow in the economy through intermediation: If I have a high return, I will try to borrow, for example as a company, in the bond market. There’s this well-known fact in financial economics that if a corporation issues a stock, the market views that as bad news. The idea is that if, as the insiders, I think that I have a great project with high future returns, I will not issue a share of that profit to you.

Instead, I will issue a bond, so issuing a bond is viewed as good news, because it shows that I trust my returns. I want to keep it. So in the example that you give, yes, there will be funds flowing. But the low-return individual will never get the high return of the investor.

**Andolfatto:** OK, not quite the high return. But of course low-return investors could invest in the bonds that high-return investors issue. And they would get a higher return, just not the highest return associated with the equity finance is what you’re saying.

**Guvenen:** I can give you a few examples. If you had the foresight to buy Apple stock in 1980 at the IPO price, between 1980 and 2015 you would have earned an average annual

return of 20 percent. If you look at some very successful hedge fund managers, like David Tepper, who is a billionaire, his average return, again, is estimated to be 20 percent.

If you compound that, the value of the Apple Corp. has gone up 400-fold. This is far above what the U.S. stock market pays on average. And it's incomparable to what the bond market pays. So there are these huge differences across the returns that individuals get, and there's some evidence that these are very persistent over time.

**Andolfatto:** So maybe this is related to my comment I'm about to make, but you're picking the cherries here, the winners. Of course, the winners are making these huge returns. But we don't know who's going to win beforehand.

**Guvenen:** Sure, but that's precisely the idea. We can prove that, in our framework, if you impose wealth taxes without knowing who earns what, it will select automatically, going forward, those who have the high return. They will keep that high return. And those who have low return will automatically actually be pushed down.

**Andolfatto:** So the wealth tax then is taking the appropriations out of the wealth and not the income. This is the sense in which it constitutes a relative subsidy to the high productivity?

**Guvenen:** Absolutely. The way I describe it is, it's a wealth redistribution from the nonproductive wealthy to the productive wealthy. If you look at the data, you see a lot of children of very successful entrepreneurs inheriting billions of dollars, but then they have other ambitions. And so some of them give to philanthropic causes, which is fantastic. But at the same time, you might wonder: "Well, if I give that to a startup with great ideas ..." We are not literally transferring it, but the system does this automatically by lowering the tax rate on the startups and young entrepreneurs and taxing instead individuals with huge wealth and no return.

**Andolfatto:** The way we're speaking here is as if the policy is actually appropriating funds from the less productive and reallocating it to the more productive. But that's not what's happening directly. The simple point is that the government wishes to collect some revenues through taxing capital. What's the best way to do this? We can tax capital income. Of course, higher capital income is indicative of a higher skill, so we're penalizing skilled entrepreneurs. And as opposed to, say, somebody who just owns wealth that earns zero return.

They would escape a capital income tax, because they generate zero capital income.

So that's a sense in which we're penalizing the productive entrepreneurs and subsidizing the not-so-productive. But you're recommending sharing the burden more equitably in a sense and at the same time increasing the after-tax return on capital. Is that basically it?

**Guvenen:** Yes. I can give you an example that applies very well to developing countries. I'm from Turkey. When I grew up, the wealthiest individuals in my town were farmers, very large farmers owning like 10,000 acres of land. As we know, it's a very low-productivity business, but you have so much capital—in this case, land—that you can make a very good living out of that. In the 1990s, Turkey, and my town in particular, switched to textiles.

These are factories and manufacturing earning much higher returns, especially in the '90s. A lot of these farmers did not have the right skill to switch into textiles. So in this example, you have a slow-growing sector like farming. A new technology arrives that grows much faster. Capital income taxation will actually collect all the taxes from the small but very productive textiles and leave untouched the farmers, whereas wealth taxes will make them say, "Wait a second." For the one who is more productive, the return will fall much less, because the tax base will be extended to the farmers.

**Andolfatto:** So, essentially, we're just arguing for a more efficient form of wealth capital taxation here. And you built a formal mathematical model to try to estimate the gains to such a switch. Do you find that your model estimates that the gains are potentially large? Or could you identify the circumstances where they may be large or small?

**Guvenen:** Yes. By comparable estimates of different policies that economists have studied: What if we reduce capital income taxes or increase labor income taxes? There is a large literature in public financing macroeconomics studying this. By comparing to the numbers in those literatures, yes, the potential welfare gains are quite large. One interesting feature of the change, if we were to change today from capital income taxes to wealth taxes—in a revenue-neutral way, because the government keeps the same revenue—the economy will adjust such that, on average, there will be less need to accumulate wealth in the economy. So the overall what we call the wealth-to-output ratio or the wealth-to-GDP ratio will fall by about 10 percent.

And the reason that you can do that is because the capital

will be allocated to the more productive individuals. Overall, we will have to hold less wealth, but output will go up, wages will go up, and welfare will go up. Again, all of it is coming from removing this misallocation of capital to low-productivity individuals. So, many policies that are recommended by economists, they pay off in the long run, like what we call the steady state.

You change the rules of the game. You change the tax law. After 10, 20 years, you reach a new kind of plateau where things look better. But oftentimes along the transition path, along those 10, 20 years, there will be some suffering. You will have to accumulate capital. You will have to consume less. In the policy we are studying, it's the opposite, actually, because you will move from a high-wealth economy to a low-wealth economy, so you can dissave along the way and still produce more.

**Andolfatto:** So we could finance a consumption boom along with this: higher material living standards for everybody as we deplete our wealth. We don't need as much wealth, because it's going to be allocated in a more efficient manner.

**Guvenen:** That's the key idea.

**Andolfatto:** And, actually, our incomes will generally be higher, real wages?

**Guvenen:** Even those who don't have wealth benefit from this, because wages go up.

**Andolfatto:** In terms of the practical considerations of tax collection, is there any reason to believe that collecting a wealth tax might be more difficult than taxing capital income at its source?

Let's suppose that I'm an idle rich person, I have this account that's currently sitting somewhere, and I'm a U.S. citizen. It's very easy to switch citizenship, I suppose, or perhaps move the account offshore; I don't know how it works. But capital income though is generated domestically. You have to file income tax. I'm wondering as a practical matter the possibility of avoiding the wealth tax.

**Guvenen:** I think there are two separate issues, and you raised one of them. If we start taxing the low-productivity wealth, you might want to shift your wealth. And we do see individuals actually having their hedge funds or their investment accounts in Bermuda, in Grand Cayman, in some other places. In that regard, I frankly don't find it to be too different.

There's a separate issue, which is the reporting and doc-

umenting of the wealth. If anything, it might be easier than what we currently have, because currently at the end of the year, brokerage houses send to the IRS every single transaction on our investment accounts. If I sell a stock, is it a short-term gain? A long-term gain? What's the cost basis? So that system is already in place. Rather than taxing the income that accrues and looking at every single transaction, you can just look at the total wealth that you have.

Wealth taxes have also been implemented in about 10-15 OECD countries over the past century, so some countries actually started in the 1920s and have taxed throughout the century. Norway is an example. Sweden is an example. France is an example.

When you look at the actual reasons they tax, there is always an argument about equity. But there hasn't been an argument or a theoretical quantitative study that shows that you can actually have efficiency improvements from this, which is the contribution that we make.

**Andolfatto:** That is the interesting part of this, and the fact that you find that the gains are potentially large. If I understand correctly, the redistribution that occurs sounds like it might occur at the upper levels.

**Guvenen:** It does very much so. If you look at the numbers, the top 1 percent holds about half of the stock market, both directly and through mutual funds. So they do also pay a very large fraction of individual income taxes. The estimates range from 35 percent to about 40 percent. So, yes, this change will be mostly a redistribution within the very rich and we hope in the right direction from an efficiency perspective. But the rest of the population, they will be positively impacted through the productivity gains and higher wages.

**Andolfatto:** I should have asked this earlier. When you say "wealth," exactly how is it measured in your model? Does your model say something about the type of wealth? Should it be that people's equity in their homes be taxed? Or are you talking about something else, like financial wealth?

**Guvenen:** We always have to be careful when we map a model into the data for, you know, the reasons that you just raised. My personal view, partly influenced by our study, is that we are not really talking about housing wealth. We are talking about capital that can produce goods and services.

**Andolfatto:** Well, housing produces goods and services, right?

**Guvenen:** It does. So I actually wanted to put that carefully. It produces services just for the owner, whereas if you're a factory, you can produce for thousands of people. And if you look over the century at the returns that you get on housing, they are very low across the board.

And I believe there is a much bigger luck component. A lot of my very good economist friends have lost huge sums on their housing investments. So I think luck plays a much bigger role. These are regional shocks, and they are very hard to forecast. So the thinking is: It should be actually what I call broadly productive capital.

**Andolfatto:** This program sounds like it might be especially attractive to emerging economies. Is there a reason to believe that's the case?

**Guvenen:** Yes. There is this idea in economics going back to Simon Kuznets, which is called structural transformation. As economies develop, they move from agriculture into manufacturing and then from manufacturing into services.

Countries like the United States are in the last stages of that, where we are switching out of manufacturing into services. But in many developing countries, I think they are still moving from agriculture to manufacturing. And there's a lot of evidence that the productivity of agriculture in developing countries is very low. In that situation, you are going to accelerate the transition, and you can potentially improve the speed of growth in those countries.

**Andolfatto:** I suppose the politics might get in the way of this in many of these economies. Do you get the feeling?

**Guvenen:** That's true. Whenever we talk about taxation, the economics of the problem is one issue, but the political economy is another one. There are definitely challenges there, but there are also challenges about taxing capital income.

**Andolfatto:** I guess one way to address it is, people have to have an incentive to adopt these proposals, and we're speaking here about a change in one dimension of the tax code. But possibly, everybody would be on board with a more efficient tax code. Are there other dimensions of the tax code that could be changed at the same time while these policies are being proposed? Does your paper speak to that at all?

**Guvenen:** Yes. The main analysis is an optimal taxation exercise. And by that, we imagine a government that has policy tools. These are labor income taxes, consumption taxes, and in one scenario, we look at capital taxes, while in the other scenario, we replace capital taxes with wealth taxes. Then we say, "If you are a government that has to raise a certain amount of revenues, and you can choose freely among these three policy tools, how do you choose?"

One thing we find is, when you switch from capital to wealth taxes, because it's more efficient, it actually allows you to reduce the taxation on labor, because labor taxation is quite distorting. And the way we are doing the wealth taxes, it's not. So there's an additional benefit that comes from the ability to lower labor income taxes.

**Andolfatto:** In a representative democracy, this type of tax reform should garner a large support, one would hope.

**Guvenen:** Absolutely. We find that in the most general case we study, about 88 percent of the population from all age groups and all wealth groups would be in favor of it.

#### **The paper's main takeaways, according to Guvenen:**

- In any modern economy, there is a lot of wealth that is allocated to individuals who are not especially good at using it. We are proposing wealth taxes, which are an automatic way of shifting the tax burden from young, productive investors who have low wealth to typically older and wealthier individuals who have low return.
- There is a global aspect to this in terms of whether this will contribute to some investors taking their wealth and going away. I predict the opposite to happen: High-productivity, high-wealth individuals from other countries actually might want to relocate to the United States or any other country that has wealth taxes.

To watch the interviews from the conference, visit <https://www.stlouisfed.org/connecting-policy-with-frontier-research/2015>.



## Erik Hurst

*The University of Chicago*

### “The Aggregate Implications of Regional Business Cycles”

**David Andolfatto:** Can you tell me what your paper is about?

**Erik Hurst:** There’s a large literature among many applied economists who try to use regional variation to try to learn what was driving the aggregate business cycle during the Great Recession. People say, “Hey, maybe we have variation. Something happened in Las Vegas. It didn’t happen in Dallas. Maybe we could use the variation between Las Vegas and Dallas to tease about mechanisms that were driving the Great Recession.”

We say there are things to learn about the difference between Las Vegas and Dallas. But it’s much harder to draw aggregate implications. What drove the business cycle from just looking at local variation in GDP and such from these local cities?

**Andolfatto:** Can you give me an example of how other researchers have made a mistake in misinterpreting regional variation and ascribing incorrectly the cause of the recent recession?

**Hurst:** There’s a large literature about the role of housing and how it affects households—me and you—in terms of our decisions. House prices plummet, and we feel poor, so we stop spending. Those types of stories, people have done by running regressions, just simple statistical correlations between what happened to your house price and what happened to things like local employment in a given area. And they found places where house prices fell the most, like Las Vegas, had the biggest declines in employment relative to places like Dallas.

The problem with those stories is, when you look at what’s going on between Las Vegas and Dallas, policymakers like the Federal Reserve could come along and offset those types of shocks by lowering interest rates, trying to stimulate spending on the household side, which is exactly what the Fed did in 2008, 2009, 2010 and such.

If that’s the case, any shock like that at the aggregate level could be offset by the Federal Reserve. Because the interest

rate is the same in Dallas as it is in Las Vegas, all of that gets differenced out.

Low interest rates were in Dallas. Low interest rates were in Las Vegas. That increased spending in both of those places. So if the housing shock declines spending, the interest rate shock could have increased spending and those could push against each other.

Think about it this way. You have a simple graph with how much house prices declined on the one axis and how much employment fell on the other axis, and each observation in this graph is a city. What the regional variation gives us is the slope of that line. What it doesn’t give us is the intercept of the line, where the line’s going to, how high or how low the line is.

Anything that moves all cities up and down, you have no way to identify this. We’re thinking hard about this variation between Las Vegas and Dallas. You need some structure to do this. You need a little bit more modeling and assumptions. How does that all aggregate up? Then we can talk about policy that affects at the aggregate level as well.

**Andolfatto:** When you say things like “the housing shock,” my understanding is there is a great deal of regional heterogeneity in the housing shock. Las Vegas’ home prices fell a lot. It’s probably not surprising that the construction sector was hit and construction workers got laid off. That seems kind of obvious. And other jurisdictions were not so hit hard. To a lot of people, this just seems like common sense.

But it’s still not clear to me based on this common sense kind of observation: How does an economist potentially go wrong in identifying what ails the economy and what should be done?

**Hurst:** During the Great Recession, nominal wages in the U.S. actually rose from 2007 to 2011 despite very weak labor markets, and real wages stayed right on trend. Real wages have been essentially growing at zero rate since at least 2000, and probably before. During the recession, real wages grew at zero percent.



So you look at the data and say, “Wages aren’t adjusting that much during this recession despite the fact that we had a huge decline in employment.” You might think if firms don’t want to hire as many workers, the price of workers should fall. So people have told stories now that there’s some friction: That’s just something messing up how the economy works, and the wage-setting process is part of the thing that makes the recession worse.

In a world where wages don’t fall, certain types of shocks could have a bigger effect on employment, and certain types of shocks, like a housing shock, could have bigger effects in the aggregate level if wages don’t adjust.

Now you go look at the local data. Again, this might not be surprising to a lot of people, but when you go to the local data and you look at Las Vegas and the employment is falling, you see wages are falling like crazy. It doesn’t make sense. Anybody who’s working in Las Vegas now probably knows that their wages were growing at a lower rate than it would have been in the prerecession periods.

When you compare them to Dallas, whose wages were growing relatively robustly during this period, you could see there’s a variation. This causes a puzzle, and this is the whole part of the paper. The first part of the paper is just setting up this puzzle. I think that’s value added itself.

It sounds crazy, but no one has ever looked at local variation in wages during big recessions to get a sense of how wages adjust. We do that. We put together data to try to measure wages, adjusting for the fact that certain types of people might lose their jobs and we might not be able to observe their wages. You have to make some adjustments for that.

Then you look at the data. Now you have how much employment has changed in each city on one axis and how much wages have changed on the other axis. You see that places with the biggest unemployment increases or the biggest employment declines had the lowest wage increases. So that variation across regions doesn’t look like the variation at the aggregate:

- At the aggregate, big increases in unemployment, no change in wages
- At the local level, big increases in unemployment, big relative declines in wages

So that’s the puzzle, and this is why the title of the paper is *The Aggregate Implications of Regional Business Cycles*. If the variation at the local level is different than the aggregate level, what does that mean when the U.S. economy is just the sum of the local levels?

**Andolfatto:** You’ve identified the puzzle. You develop a theory to interpret the puzzle, or understand it. What’s your theory about what’s driving this puzzle?

**Hurst:** Now we try to do like I just said: We’re going to take each one of these parts of the U.S. In our data, it’s actually going to be U.S. states. We’re going to make a model of each one of the U.S. states that aggregates up to the U.S. as a whole. Anything that goes on in these local areas eventually has to sum up to what goes up at the aggregate level. In our model, there are certain types of shocks and certain types of assumptions on what the households do, what the firms do, what the government does, etc.

Let me tell you about these shocks, the things that could drive business cycles in general. These are metaphors for the type of shocks that most of us have talked about during the recession. We have some shock that hits the household sector. That makes them want to spend less, and you can think about that as being like a housing shock. People have told those stories that house prices have fallen. People can’t borrow as much money to fund their consumption.

We have one type of shock that looks like that. We have another shock that hits the firms. Those shocks make firms want to hire less at any given rate, maybe like a productivity shock on the part of firms or a borrowing cost shock for firms. Firms might go to banks and maybe not be able to borrow as much.

The third shock is leisure shock. Some people have said the story that something has made us want to work less than we did in the past. Maybe it’s that our government policy has made us want to work less. Maybe something hit certain sectors like manufacturing, and it takes a while for workers to reallocate to other sectors.

Those are the three types of shock. Every one of these shocks has an aggregate component and a regional component. We define the regional components so that they sum to zero. Anything that moves all regions, we’re going to call an aggregate shock, and anything that moves your region relative to the aggregate we’re going to call a local shock. Every shock has those components.

**Andolfatto:** And is it something you’re going to estimate using the data and using the model?

**Hurst:** Exactly. Let me just tell you two other things about the model that I think will be important. The first thing is that regions are connected to each other. They could trade goods with each other. As a result, shocks that hit you might spill

over into me because if I produce cars and you're in Las Vegas and you don't want to buy as much, it's going to affect how much I'm going to produce there. So we could trade with each other, and that's one thing that makes the regions different than the aggregate.

The second thing is that there's a Fed, and the Fed is in the background. They're moving around interest rates, and the interest rates are the same in all the places of the U.S. Interest rates are the only shock that has no regional component. So we're going to have a fourth shock I should have mentioned. There's a Taylor rule, and sometimes they could do things to move us above and beyond the Taylor rule.

Then the last thing is that the assumption I want to have—and this is what we're really going to estimate—is how sticky nominal wages are. There's a local stickiness to local shocks and an aggregate stickiness to aggregate shocks. Because eventually everything's going to aggregate, the local wage stickiness parameter will then map directly into the aggregate wage stickiness.

**Andolfatto:** You introduce this local nominal wage stickiness because it's going to be necessary for your model to interpret the data?

**Hurst:** It's twofold. One is that those spending shocks in the household sector don't really have any effects on recessions unless you have some friction in the model. So we needed some friction.

And the second thing is, when you look at the data, it screams that there is some wage stickiness. Shocks that occur today might not affect your wages until tomorrow. Why? For example, being at the University of Chicago, my wages are set once a year. Things that happen in December don't show up in my wages for a while.

**Andolfatto:** It's consistent with what we observe at the local level as well?

**Hurst:** Exactly.

**Andolfatto:** So you develop this theoretical framework. You've got your interpretation. Now you formally estimate using econometric techniques. You choose parameters so that the theory has a best fit for the data that you have. What are your findings? What is the interpretation that your model offers? And how does it differ from the conventional interpretation?

**Hurst:** A lot of the parameters that were going to be used are kind of standard in literature. Wage stickiness is not standard, so a lot of our paper is on trying to estimate how sticky wages are. As I told you before, when you look at the regional data, you're going to find some stickiness in wages, but it's not huge.

When you go to the aggregate data and shocks, particularly the household spending shock, that shock should cause wages in the aggregate level to fall. Some people have come along and said, "If you believe this shock was the cause of the recession, you should see wages fall." They say wages must be really sticky.

The part of our paper comes along and says, "If they're so sticky, then we shouldn't see wages moving at the local level." And reverse it: "Given the flexibility we see at the local level, it is hard to get this household shock to do a lot of the work for the recession."

Some people believe that the recession was "demand driven," or driven by the household sector wanting to stop spending, and that's the sole story for the recession. We reject convincingly, because if so, wages should have plummeted. What we find is that about 40 percent of the decline in employment in the early part of the recession, around 2009, could be attributed to a demand shock above and beyond what the Fed was trying to fight against.

The reason why employment was still low in 2010, 2011, 2012 had very little to do with the demand shock. If it was all demand shock, wages would have adjusted to clear the market. So something happening to the firms in the economy is what we estimated. For whatever reason, firms didn't want to hire. Maybe their productivity was low. Maybe they had some friction in their lending in the banking sector at the aggregate economy as a whole. I can't distinguish between those, and we don't even try to distinguish between those. Those are kind of lumped together. The whole point was: It wasn't the household side that was causing a drag on the economy in 2010, 2011, 2012.

We stop at 2012, so anything about the recovery in recent years is outside the purview of the paper.

**Andolfatto:** Is this conclusion or this finding of your paper in contrast to, let's say, Mian and Sufi?<sup>1</sup>

**Hurst:** Mian and Sufi were really talking about 2009. They were trying to explain that a lot of the early part of the recession in 2009 was driven by the household sector. And some inside the Fed used the work of Mian and Sufi to bolster a demand driven type of recession for which the Fed should be working against.

We're saying that was part of the story, so they weren't wrong. But once you go through 2010, 2011, 2012, you can't have their story being the story, because wages would have fallen unless wages were really, really sticky. And we just estimated from the local level that wages aren't really, really sticky.

From the Fed's perspective in 2010, 2011, 2012, maybe they're propping up the banking sector. But maybe it's to help the firms in the economy more than to help the households in the economy.

**Andolfatto:** Your findings don't necessarily preclude a balance sheet recession. But the findings are that whatever these forces were, they moved from the household sector to the business sector.

**Hurst:** That is a perfect summary.

**Andolfatto:** Your model fits the data nicely at the local level as well, which I like a lot. It offers this intriguing interpretation of the crisis and subsequent developments. Does the model scream for any kind of obvious policy intervention?

**Hurst:** There's two things that I think the policymakers should take away, and I still hear some of it in the rhetoric even within the Federal Reserve right now about the stickiness of wages.

You hear the reverse sides now. The story you'll hear within this Fed right now is that wages didn't fall in 2010, 2011, 2012 because they were so sticky. Part of the reason we're not seeing the wage increase in 2013, 2014, 2015 is because we're just undoing pent up demand. I just don't believe that is a true assessment to have.

I'll even go further, though this is off-topic just slightly. When you look at real wage growth from 2000 to 2007, well before the recession started, it was zero. When you look at wage growth now, it's zero.

During the recession, if wages were really sticky, maybe that's why they didn't fall. But we're saying wages are pretty flexible. So what was going on is there is something else pushing up wages.

We didn't talk about this, but the thing in our model that's helping push up wages that we are estimating as having some effect on aggregate employment is that there seems to be something causing the household sector not to spend less but to work less, whether that is a choice or whether certain sectors have gotten hit and then as a result people have trou-

ble reallocating to other sectors. The data says that is putting upward pressure on prices.

For us and the Fed policymakers, I think what we're finding is also evidence of the same puzzle of why employment has not bounced back even as of 2015. The unemployment rate has come down, but the employment rate plummeted from 2007 to 2009 and has stayed low for workers who usually work, people 21 to 55.

I think that same shock explained why wages at the aggregate level didn't fall and why employment is still depressed in the U.S.

**Andolfatto:** This sounds like an identification of the types of disturbances, the nature that they have to take to interpret the data. But in terms of a direct policy implication ...

**Hurst:** The traditional policies that I think that could respond to that story aren't the usual ones we think of: the Federal Reserve and Congress and the president doing short-run stimulus. These might be things like job training programs or retooling workers to move them from manufacturing towards IT or some other sectors.

#### ENDNOTE

<sup>1</sup> Mian, Atif; and Sufi, Amir. "What Explains the 2007-2009 Drop in Employment?" *Econometrica*, 2014, Vol. 82, Issue 6, pp. 2197-2223.

#### The paper's main takeaways, according to Hurst:

- For those of us who want to do empirical work using cross region variation to try to learn about the shocks hitting the economy, it is more complicated than we thought when you're trying to understand what's driving the aggregate business cycle.
- Wages are pretty flexible at the local level. When we start building models of aggregate wage stickiness, we have to be confronting the fact that when you look at the difference between Las Vegas and Dallas, unemployment rates and wage rates correlate very strongly. We need to keep that in mind when we're doing this. Once you do that, wages look a lot more flexible at the local level than they do at the aggregate.



## Ayse Imrohoroglu

*University of Southern California*

### “The Chinese Savings Rate: Productivity, Old-Age Support and Demographics”

**David Andolfatto:** I thought I'd begin by just asking how macroeconomists define the savings rate. Why is it important for us to study it?

**Ayse Imrohoroglu:** I would start at the individual level, actually, to define a saving rate. For a person or for a household, it's just whatever you don't consume:

- You have your income.
- You subtract your consumption.
- The leftover is your savings.

Then, we can look at your savings as a function of your income and get the saving rate. So that will be money you put aside for the future or emergencies. Whatever you put in the bank, that would be your savings.

For the country as a whole, it's going to be not just the individuals, but it's also going to be the government and the corporations that will be behaving in a similar way. When we look for the macro aggregates, we would be taking the total income in the economy, which is GDP, and subtracting total consumption and total government expenditures from it to find the savings for the whole country.

Why is it important? Because the money you put aside is available for firms to then borrow to invest. If individuals are saving the money in a bank, let's say, the firms will borrow from that money. They buy capital goods, build factories, buy machines, whatever, and that increases the future output in the economy. So the more money that's available for firms to invest or that will become cheaper for them to invest, the more they will invest. People believe that there's a relationship between, say, how much people save and the growth rate of an economy because there will be more funds to increase the capital stock.

**Andolfatto:** Your paper is all about China, and you mention that the national saving rate in China has more than doubled since 1980. Could you give us a flavor as to what is the saving rate in China and how it compares to other countries like the United States?

**Imrohoroglu:** The particular measure of the saving rate we use is called net national saving rate. It went up from 20 percent in the 1980s to 40 percent, pretty much, in 2010. The U.S. in that measure is probably about 6 percent.

There's a huge difference between these saving rates. I'm from Turkey, and the saving rate in Turkey is also very low. Often you would see newspaper articles that would say, “If only we could save like the Chinese, then everything would be great. We would grow much faster.” So there's always this impression that high saving rates are really good and desirable, and somehow we are being very bad not doing it. The same thing happens in the U.S. Especially before the Great Recession, there were many articles asking why Americans are not saving. There were household saving rates that were negative even. So it's kind of puzzling why some countries save a lot and some countries don't save a lot. And lots of explanations exist.

**Andolfatto:** So the paper is about China, but I'm wondering if the pattern of economic development for China—in particular with respect to the saving rate—is very much different than the pattern that we've witnessed in the past with other developing economies or emerging economies. Is your paper really just about China, or can it be more applied to emerging economies in general?

**Imrohoroglu:** The same framework can be applied to other economies. In fact, my first paper on savings was on the Japanese saving rate, and we showed very different patterns.

What happened in Japan was in the '50s and '60s they had a very high saving rate. It was maybe like 25 percent with this measure. And then it went down to 5 or 6 percent. So then the puzzling thing about Japan at that point was why it was so high initially and why it went down.

For China, it's the opposite. It was low, and then it went up. I'm also looking at Latin America. I have a paper on Chile and Mexico, and their pattern is that it's very low overall. Compared to China, very, very low.

So the same framework can be used to understand other countries as well.

**Andolfatto:** Let's get to China then. The main question seems to be to understand what drives the high national saving rate in China and what caused it to double since 1980. How do you go about addressing this question?

**Imrohoroglu:** What we noticed—and everybody knows this—is that there are a few important things about China I think that might make it unique. In 1980, they implemented the one-child policy. For a country like China where children traditionally take care of their parents, that means that after 1980, in like 20 years, you're going to have many, many families with one child. Suppose two adult children get married. They're going to have four elderly parents to take care of. That's going to make it quite difficult.

Another unique thing about China is that there's no government-provided long-term care. For example, we have Medicare here. We have Medicaid for the poor. If they face long-term health risks, we have government-provided policies that take care of them.

In China, no such thing exists. With the elderly, what they do, or used to do, is that they would rely on their children. They would live with their children, or one of the adult children would take care of a sick parent. This isn't going to be able to happen. After basically 2000, 20 years after the one-child policy was passed, you're going to have more and more families who cannot depend on their children. So it's really easy to imagine that they're going to save for old age.

For that, we built a model that has dynastic families. In these models, parents and children maximize a joint utility function, so you don't have to say "This is how much they care about their children," or "This is how my children care about their parents." They care as much as they care for themselves. They're equal.

I actually like those models a lot. What happens in those models is if the children are poor, the parents will give them money. They pay for education. They take care of them. If the parents are poor or are needy, then the children take care of them. In a model like this, if you introduce a one-child policy, very naturally you get this jump in savings that we see in the data.

We have a graph that starts from 1980 and goes to 2013, and then you see the saving rate going up. We drew the model, and we were actually quite surprised at how similar the saving rates look.

**Andolfatto:** I presume your model provides an estimate of how much of the rise in the saving rate is attributable just to this one-child policy?

**Imrohoroglu:** Yes. Before I tell you that number, let me also say that there are other things that increase the saving rate. There are shocks to productivity, which make capital more productive, and then people save more because they have more returns that they would be getting. There is Social Security, which is not sufficient, so they save for that. And lastly we also introduced individual income risk into this model. So at the end we can do a decomposition. We can say, "How much does long-term care risk matter? How much does productivity matter? How much does Social Security matter?" And currently with the numbers we have, long-term care risk matters like for 40 percent.

I know typically we do these decompositions and talk about these numbers, but I'm trying to be a bit more careful about this because I hate to say that I've calibrated to the Chinese economy. It's such a big economy with so many things going on. And so many numbers are not terribly reliable. So even Penn World Tables comes up with GDP numbers that are different than what the government is announcing.

What I want to say at the end of this paper is that, with these four elements, you get something that looks so much like the reality that you never will think this is puzzling.

**Andolfatto:** So, we're happy to just say, well, the effects are likely large without actually pinning a specific number on it.

When people see China's high saving rates, it often invokes a kind of envy. But from what you've just been telling me, these high saving rates might be symptomatic of some problems in the Chinese economy: a lack of an old-age-security program or something like that, or some restrictive policy on family structure. To what extent do you think that's true? That we should be not so envious of these high savers?

**Imrohoroglu:** It's totally true. In the case of Turkey, the fertility rate is so high that people have, like, three children compared to one, and they do rely on children's support. So it wouldn't be a very good policy implication to say, "Oh, OK, have fewer children and you'll have higher savings." What purpose does that serve?

I think one has to really think deeply about why a country is saving a lot. Although an envious part, a part of the high savings in China is coming from high productivity. That part is an important positive thing.

**Andolfatto:** High productivity growth or high productivity?

**Imrohoroglu:** Total factor productivity is high, so the growth rate of total factor productivity is high.

**Andolfatto:** Don't people usually want to borrow against higher future productivity, not save?

**Imrohoroglu:** That's true, but if it's temporary, and they usually are. Those are the better times that you would invest and save. In our model, saving and investment are equal to each other.

**Andolfatto:** So technically, your theoretical framework in which you're addressing this question is a closed economy? And, of course, we know, in fact, China is not a closed economy. It was running large, large trade balance surpluses.

**Imrohoroglu:** Yes.

**Andolfatto:** That might affect perhaps some of the quantitative results?

**Imrohoroglu:** I don't think so, because if you look at the graph, both investment and saving are going up in China. It's not like they're behaving differently. It's a puzzle that saving is greater than investment, and that's the part that's creating the surpluses. That will have its own explanations, I'm sure. But what we're after is trying to understand why both of them are going up. I don't think the answers will change. I think there will be additional answers or factors to why one is higher than the other all throughout this time.

**Andolfatto:** In terms of say policy implications, if you were invited to speak on certain policy reforms, would you have any lessons to draw from this work or your other work, not only for China, but perhaps even other economies? Anything you'd like to stress?

**Imrohoroglu:** I think China is trying to implement government-provided long-term health care. And I think it is important for them to do that. People do need that kind of insurance. It's a big risk. There are anecdotal stories that some Chinese elderly commit suicide because they don't want to rely on their kids and ruin their lives. Health care risks are really important risks, and providing insurance for that is an important role of the government, I think.

#### **The paper's main takeaways, according to Imrohoroglu:**

- It's not terribly puzzling to understand savings rates. People have come up with many, many different explanations, like culture for example.
- Chinese save a lot because they're very patient. I don't think you need those things to understand the Chinese saving rate.

To watch the interviews from the conference, visit <https://www.stlouisfed.org/connecting-policy-with-frontier-research/2015>.



## Nobuhiro Kiyotaki

Princeton University

### “Wholesale Banking and Bank Runs in Macroeconomic Modeling of Financial Crises”

**David Andolfatto:** For people who are not familiar with banking and bank runs, what is wholesale banking? I suppose it differs from retail banking.

**Nobu Kiyotaki:** The traditional bank run is focused on the retail banks. Household depositors worry about health of the bank, and they run up to get money before the bank runs out.

**Andolfatto:** I guess this is like an *It's a Wonderful Life* scenario, something like a retail level of households running to the bank.

**Kiyotaki:** That's the traditional bank run. But the recent bank runs in the 1970s, Continental Illinois bank run or perhaps more importantly the recent recession's bank run is not on the retail banks but actually is centered in the interbank market or the wholesale funding market. Basically, nowadays a lot of financial institutions borrow money from other institutions, financial banks. Investment bankers, for example, raise funds mostly from other financial institutions like pension funds as well as commercial bankers. They don't raise many funds from the household.

There, the bank run is when big lenders like other commercial bankers or the insurance companies stop rolling over the loans, short overnight loans.

**Andolfatto:** So it's much like a demand deposit liability? When people have an account at their bank, they're effectively rolling over their loan to the bank night after night. And then they might all run to withdraw their cash.

**Kiyotaki:** Yes, but here you stop rolling over and financing overnight. And then this borrower—say, an investment banker—runs into trouble. They start selling the assets. When a lot of investment bankers start selling the assets—like mortgage-backed securities or lots of financial products that they hold—the price starts falling. At that point, even if at the

beginning they're healthy, they run into trouble because of asset prices dropping. They become insolvent.

**Andolfatto:** What you're describing to me—and probably this might be familiar to a lot of our audience—sounds like a standard retail-level kind of run, that the banks have to meet the large wave of demand for cash by selling off assets.

**Kiyotaki:** The difference is that the traditional bank run is based on something called the sequential service constraint, which is basically: If you go early, you get the full return. First come, first serve. And if you don't go early enough, you lose the money.

But the wholesale case, basically every contract is short term. If you stop rolling over, then the borrower runs into trouble, starts selling the assets, then at the end of the day, everybody gets hit because asset prices dropped so much.

The difference between the liquidity shortage, the shortage of their liquid assets versus illiquid, is much more subtle. When you look at the popular writing of, say, Paul Krugman, they always say insolvency and liquidity shortages are different things.

But, here, liquidity shortages quickly transformed into insolvency because the asset prices, like mortgage-backed securities prices, were dropping. Then they are in trouble. So the question is, how do you stop this kind of bank run? Or what is the cost of the bank run?

**Andolfatto:** Before we get there, I'm aware of different theories as to what actually triggers these events. In your view or in your model, what causes these things to happen?

**Kiyotaki:** Before the crisis, we have a big buildup of the wholesale funding market. Basically, the investment bankers and all these financial intermediaries will rely on the funding from other banks. Other financial intermediaries become very big.

GENERALLY, EXPANDING THE WHOLESALER BANK ITSELF IS NOT BAD. IF THE WHOLESALER HAS BETTER LOAN OPPORTUNITIES OR BETTER FINANCING TECHNOLOGY THAN RETAILERS, THAT'S A GOOD THING. BUT IF THEY BECOME TOO BIG RELATIVE TO THEIR NET WORTH AND SO-CALLED LEVERAGE BECOMES TOO BIG, THEN THEY BECOME VULNERABLE FOR THIS TYPE OF WHOLESALER BANK RUN.

That itself is not bad. If a wholesaler has better lending opportunities, more funds go to the wholesale banker, which is a good thing. But when a negative shock hits—like, say, default of the mortgage markets—it will hit the most vulnerable sectors or, in this case, the wholesaler who relies heavily on the short-market funding.

If nobody stopped rolling over as the price stays high, the wholesale banking sector is still solvent. But if people stop rolling over and if government doesn't intervene, then the price drops enough, and then entire wholesale banking sector gets hit.

**Andolfatto:** So there is a psychological component here that's triggered by a small fundamental shock?

**Kiyotaki:** Yes.

**Andolfatto:** The traditional kind of retail-level bank runs rely on esoteric things like first come, first serve. But, here, this is different. It doesn't rely on that. And the institutions operating in this wholesale market, they would be who? JPMorgan? Bear Stearns? Lehman Brothers? The money market mutual funds as suppliers? These are the agents that are operating in this wholesale market?

**Kiyotaki:** Yes.

**Andolfatto:** So that's the triggering event. There's a possibility of a contagion, but if everybody remained calm, it would be fine. But people stop rolling over the debt, and this precipitates a sale of assets. Is there some friction in these? They're illiquid or something?

**Kiyotaki:** Yes. If these assets are sold in the market for the potential value, like with other retail banks or maybe non-

financial sectors, they are not good at dealing with these assets, say mortgage-backed securities. They cannot use your household to buy these kind of things.

**Andolfatto:** They're pretty esoteric products. They're idiosyncratic. You don't know if they're good or bad.

**Kiyotaki:** Yes, and, usually, only professionals buy. But if professional buyers are concentrated in the wholesale banking sectors and start selling the assets, the potential buyer may not want to pay too much. In a height of crisis, they try to sell very high-grade tranches of the mortgage-backed securities, and the price drops to like 22 cents for a dollar, even if the default rate is tiny.

**Andolfatto:** I think that's an important point. It's even these AAA-rated tranches of private label securities, these mortgage-backed securities. People may laugh that the ratings were not appropriate. But in fact, as you pointed out, they continued to service them. They did not default. Arguably, they were rated correctly, because they don't measure liquidities.

**Kiyotaki:** The liquidity here is that the potential buyer is not as good as the usual buyer. And the usual buyers in this case, like wholesale bankers or investment bankers, are shorting cash.

**Andolfatto:** Who's shorting the cash here? Lehman? Why don't we use an example?

**Kiyotaki:** So Lehman's lender stopped rolling over the short-term credit, stopped lending to Lehman. They have to sell the assets in the market.

**Andolfatto:** I heard Lehman was heavily invested in subprime. And this is not exactly the AAA-rated stuff you are talking about.

**Kiyotaki:** No, at the end of the day, their subprime securities default rate was not that bad.

**Andolfatto:** So when people label these things "toxic assets," what are they talking about?

**Kiyotaki:** If you look at the most senior part of the toxic asset, asset-backed securities, the default rate is not that high.

**Andolfatto:** But was that what Lehman was investing in?



**Kiyotaki:** Yes. They do have a lot of the asset-backed securities, especially the subprime-backed securities.

**Andolfatto:** So you're talking about the senior tranches of the subprime?

**Kiyotaki:** Yes. Subprime itself can default. But if you have an asset backed by the subprime, the first loss is absorbed by the other people, then the senior part is relatively safe.

**Andolfatto:** So, arguably, Lehman wasn't really doing something terribly bad, was it?

**Kiyotaki:** But the lenders stopped lending. Not just Lehman, but Bear Stearns and even Goldman Sachs, they had trouble with funding during the crisis. Then they started selling the assets.

When the price is dropping, usually it's good news for the buyer. But this time, they have a big debt. Then the net worth, the assets minus the debt, moves a lot, and sometimes it becomes negative.

**Andolfatto:** We've got Lehman here. They're going long on these mortgage-backed securities. They're going short on Treasuries and cash. We have this event that causes the prices of these mortgage-backed securities to go in the wrong direction. And Treasuries are actually going the opposite. So Lehman has just made a bad bet.

**Kiyotaki:** And their net worth becomes negative. Then they are going to be insolvent.

**Andolfatto:** Do you think that if the creditors to Lehman had just maintained their cool that Lehman would be in business today? Is this your feeling?

**Kiyotaki:** If the majority of the investment banking is still getting funded, then it would be.

**Andolfatto:** We have this disruption in the wholesale banking sector. Lehman is getting creamed on its positions. All its bets are going all the wrong way. Why should the rest of America care?

**Kiyotaki:** It affects the spread between the assets, illiquid versus liquid assets. During the crisis, as you said, the interest

rate on Treasury securities drops. But the interest rates on risky mortgage-backed securities or commercial papers go up.

So the spread expanded, and the spread expanded particularly severely after the summer of 2007, and then shot up during the Lehman crisis. And when the spread goes up, it will affect the households borrowing money from the bank or the nonfinancial businesses borrowing money from the bank.

**Andolfatto:** This directly impinges on the credit conditions of households or businesses just wanting to borrow funds to buy homes, to do capital spending, and that's how it affects the real income. So what should we do about it?

**Kiyotaki:** Generally, expanding the wholesale bank itself is not bad. If the wholesaler has better loan opportunities or better financing technology than retailers, that's a good thing. But if they become too big relative to their net worth and so-called leverage becomes too big, then they become vulnerable for this type of wholesale bank run.

Basically, before the crashes hit, you might not want to have too much leverage. Or the other way to say it is that this important banker should have more capital relative to the assets.

That's ex-ante policies. Ex-post policy is that you might want to stop the asset price collapse during the crisis. That's more like a lender of last resort style intervention during the crisis.

**Andolfatto:** They call this sector the shadow banking sector. Many, like the Fed, did not have jurisdiction to kind of actually regulate many of these entities. We can kind of see Lehman, but there are many others of these institutions. And they operate in these opaque over-the-counter markets.

It's one thing to say that we should impose capital controls or some sort of regulation on this sector, but as a practical matter, given that it's in the shadows, do you think that it's possible?

**Kiyotaki:** Yes. By definition, like I said, the regulation of banks is very hard. Therefore, ex-ante, you worry where the risk is building up.

**Andolfatto:** But how can we even see the risk building up? We can't even see these people's portfolios.

**Kiyotaki:** There is some balance sheet data. The BIS tried to get some data on shadow banks. And some of the banks are no longer shadow, like many other investment bankers who survived are already under the regulation of the Fed.

**Andolfatto:** Right. Much of the shadow banking sector probably is outside of the existing regulation. I guess the worry is that these people are clever. They're going to try to innovate around. What can we do?

**Kiyotaki:** What we can do is the ex-post.

**Andolfatto:** There's nothing we can really do, but maybe ex-post, the Fed could serve as a lender of last resort?

**Kiyotaki:** Or try to limit the damage, in case shadow banks can become insolvent. At the same time, you don't want to do regulations that are too severe. As you said, as soon as you put in very severe regulations, people try to avoid that.

One example recently is the Bank of England, which is saying, "We don't want to ban the high loan-to-income-type mortgage." Some people don't have much income but nonetheless want to buy the house, especially when they are very young. If the banker is lending this, they have extra capital requirements. And this regulation is not too big of a tax on the extra capital requirement.

At the same time, if housing prices are going up, the loan-to-value regulation doesn't work well because the value is already getting high. But the long-term-income one is going to work when the housing price is booming. During the boom, the requirement gets a little tighter, and during the recession, it's relaxed. So that's the kind of policy people are talking about.

**Andolfatto:** Do you have a view on the Fed's intervention in 2008? Was it successful?

**Kiyotaki:** I think so.

**Andolfatto:** Was it a bailout?

**Kiyotaki:** No, because the Fed actually made a huge amount of money. If it's a bailout, the price is higher than the real value. That is a subsidy to the seller of the assets.

But the Fed actually made a huge amount of money with almost every program they did. How effective? People are debating. But it's not a bailout or money transfer to the big bankers.

**The paper's main takeaway, according to Kiyotaki:**

- We have to worry about the new type of financial crisis centered on wholesale banks and shadow banks. The development of shadow banks itself is not the bad thing. But the potential risk is that they are vulnerable to the rollover risk, and policymakers should be prepared to act.

To watch the interviews from the conference, visit <https://www.stlouisfed.org/connecting-policy-with-frontier-research/2015>.



## Ellen McGrattan

University of Minnesota

### “Intangible Capital and Measured Productivity”

**David Andolfatto:** Could you start by giving us an idea of what this paper is about?

**Ellen McGrattan:** The paper is part of a bigger research program focusing on intangible investments. By intangibles, I mean things like research and development, software, mineral exploration, and artistic originals.

When you watch *Gone with the Wind*, for instance, profits are made by firms that produced it, and those profits are long lasting. We need to take into account that some of that profit is an investment. This issue is relevant for business cycle research, which is something I'm interested in, because when firms make large investments—and in the U.S. they do—it matters if they are not counted. Think about the national accounts of, say, the United States or any other country, and the calculation of gross domestic product. Prior to 2013, investments in intangibles such as research and development were not counted in GDP.

For example, during the tech boom of the 1990s, companies were doing lots of research and development. We have the Internet coming online, big developments in telecommunications. We did not see large increases in output. We did see large increases in inputs like hours of work. So measures of productivity, like GDP per hour or something we call total factor productivity, did not change a lot—it seemed like the economy wasn't booming, when in fact the economy was booming.

**Andolfatto:** You mentioned when we watch *Gone with the Wind*, an intangible form of capital that generates a stream of income. But surely when we watch *Gone with the Wind*, it generates advertising revenue for the owners of this capital. Isn't the income produced by that capital counted in the GDP? What is not counted then? The actual investment?

**McGrattan:** Yes, the investment. Let's go back to basic economics. We count our products and our incomes. Wages to researchers and developers—the scientists—that gets counted.

Wages to those in advertising—that gets counted. But the actual investments show up as intermediate goods. It shows up as an expense to the firm. Effectively, it looks like the investing firms have lower profits and lower investments. It's counted in some sense, but as an intermediate good, not as a final good.

When we add up everything to get total GDP produced in the economy, what it looks like is simply that one business paid another business. The investment wasn't capitalized; it was expensed. So we—the macroeconomists—don't see it. It looks to us like output or GDP, as we normally measure it, is not booming when other things like tangible investment, investment in buildings and equipment, and hours *are* booming. To us, it looks very confusing because we think: “Wow, these are good times, but we don't see it in the productivity measures.” We are left wondering what is going on.

**Andolfatto:** Is this mismeasurement issue more of a recent phenomenon?

**McGrattan:** We don't know. Ed Prescott, who's at the Federal Reserve Bank of Minneapolis and Arizona State University, and I have been involved in different projects that look more under the hood to better understand the measurement. We did a study of the 1990s.

This work that I'm doing now tries to look beyond the 1990s to see if there is a problem of measurement more generally. I'm aided with data from the Bureau of Economic Analysis. In 2013, after we did our study of the 1990s, the BEA introduced some of the intangible investments into the accounts. They now include research and development and software as final goods.

**Andolfatto:** But when they included it as expense items, you have data for that as well, do you not?

**McGrattan:** We did. We always had part of it. We have what the BEA calls the input/output tables. In the input/output tables, you'll see estimates of intermediate inputs. We also have survey data from the National Science Foundation since 1953.

So we knew these investments were being made. That helped us when we were thinking about the 1990s, because we could look at those investments directly. The BEA is now coming up with a new concept of GDP and integrating information on intangibles into their notion of output or GDP. This information was not in GDP before.

**Andolfatto:** If a dedicated researcher wanted to, they could go back and reconstruct the actual GDP? And when one does that, people would be interested in what the differential is over time? Is it a lot? Has it been growing when one performs this exercise?

**McGrattan:** It's interesting that you ask that, because the best guess is that only about 30 percent of intangible investments—what people have measured directly or indirectly—is currently included in GDP. So there's still a big measurement issue.

There is a lot of indirect evidence. We can see stock valuations. When companies make investments, their stock values reflect that. But as you know, the stock valuations move around a lot. It's oftentimes hard to disentangle the investments from other things that might be changing their prices.

It's a bigger research program—bigger than just this one paper—to try to get an overall sense of the impact that these intangible investments have on the overall macroeconomy.

**Andolfatto:** It might be useful to just really briefly describe what you and Ed did in terms of explaining the '90s. What was the puzzle there? What was the resolution?

**McGrattan:** When we were thinking about the 1990s, I was at the Federal Reserve in Minneapolis. The president, Gary Stern, repeatedly asked us: "Why are hours going up so much? Why is employment booming? I don't see anything in the productivity statistics. You guys study theories where productivity matters a lot. Explain it to me." We had no good answer. We scratched our heads for years.

Meanwhile, we had been doing another study that looked at stock valuations. We quantified the size of the intangible capital stock. At that point, we connected the dots. We realized that introducing intangible investments could help us think about both stock valuations and business cycles. If it's missing in our models of the stock market, it's missing in our models of business cycles.

So we scratched our heads for a long time, but we figured out that the lackluster productivity measures were a result of our mismeasuring GDP. We extended the standard model. And when we extended the standard model, we saw that the big hours boom was not only showing up in the data but also showing up in our theory once we accounted for the intangible investments.

Now the 1990s is a period of a big boom. When you look more recently—say, at the downturn of 2008–2009—you will see the flip side. We see that measures of productivity didn't fall very much, but GDP and hours fell a lot. That's why I started thinking that a more general issue of mismeasurement is involved here. We're seeing little change in the measure of productivity with big changes in economic activity, a fact that has sent people in many different directions, for example, thinking that it's got to be something about financial markets or something about labor markets. It could be that our old standard model actually does quite well in accounting for the downturn if we properly measure movements in productivity.

But it is the flip side. The period of the '90s was a boom. The recent downturn is a recession. If our theory is right, we should see little movement in measured productivity and conventionally measured GDP and lots of movement in hours.

**Andolfatto:** The question you're asking is one of trying to understand to what extent this intangible capital is playing into the dynamics of the measured productivity over the course of now the recession that we just came out of? You use a model to bring to bear on this question. How do you do this? What are you doing here?

**McGrattan:** First of all, I go to the data. I look at the new accounts, how they're remapping the input/output tables and redefining GDP. I made further updates beyond what the BEA has done to reallocate other categories that I know are going to be reallocated in future revisions of the national accounts.

I use those new accounts to parameterize a theoretical model. I know things like, for each industry, how much is spent on intermediate inputs, how much is sold to consumers, how much is sold to other businesses in terms of capitalized investment. I can use all that data to parameterize the theoretical model, updated to include intangible investments.

Then I ask myself: "What's the contribution of just the ebbs and flows of productivity over the business cycle from the lens of that model?" To answer this, I have to use some statistical methods to simulate the model and compare the model's prediction with the data from the BEA. The idea is to work with parameters of the model that imply a good match between

model predictions and observed outcomes.

I want to also allow for the possibility that I could be completely wrong: The model could be a bad match to the data. To allow for this, I include some measurement error. The way I add the measurement error is very specific. I know the old models without intangible investments did a very poor job in matching hours. That's what we saw in the '90s. I allow for something that could make hours move around, as we saw in the U.S. data. Then, if the theory is wrong—if productivity is not affecting intangible investments, and intangible investments aren't affecting GDP—the measurement error would account for movements in observed data.

If I found that measurement error was needed, I'd say this is a poor theory of the U.S. economy. The main finding is that the added measurement errors are small. In other words, the extended model with the intangible investments included does a very good job accounting for the cyclical activity over the U.S.—all the way back to 1948.

**Andolfatto:** For this model, it seems to fit the data pretty well, especially when you account for the intangibles. What does the model identify as the causal impulse of the recent crisis and recession?

**McGrattan:** That's a good question, because we're taking as given that there are fits and spurts in actual total factor productivity.

**Andolfatto:** So the actual is unobserved as far as you're concerned and you're trying to estimate it?

**McGrattan:** Exactly.

**Andolfatto:** Was it a sectoral TFP movement or was it an aggregate?

**McGrattan:** It was something hitting all sectors. It was something hitting the common component of TFP. And it's coming in strongly for all the sectors in the model. Now one might ask: "What generates this?"

**Andolfatto:** And was it actually a decline in the TFP?

**McGrattan:** I'm talking about changes relative to a trend. If you think about total factor productivity—I want you to think back to 1900 in the U.S. and all the way up to 2015. With the same factors of labor and capital over time, we make more

THE GOVERNMENT COULD FIX SOME REGULATORY ISSUES—NO DOUBT ABOUT IT. BUT IF IT'S ABOUT HOW MUCH WE'RE GETTING OUT OF SCIENTIFIC PROGRESS—THOSE EBBS AND FLOWS IN SCIENTIFIC PROGRESS—THERE'S NOTHING THAT THE GOVERNMENT CAN DO ABOUT THAT.

and more widgets, and we do better and better. We're more and more efficient.

What I'm looking at are movements in efficiency around that overall growth trend. When I say it's going down, it's really not going down overall because there's an overall upward movement in our knowledge. We get better and better at producing with the same amount of inputs of capital and labor. But sometimes we're really good, and sometimes we're not as good. There can be times when there's very high total factor productivity relative to trend and low.

Now there are also some negative factors—for example, when anything hinders efficiency. If you increase regulatory burdens for firms, that can look like a negative or a not-as-good time for productivity, because you're affecting the efficiency of firms. When the firms have to do a lot of accounting for every little detail, that can look like a negative productivity shock in my model.

**Andolfatto:** Many critics of neoclassical theory will point to what they regard to be the implausibility of these major events, these crises. Well, it's perhaps a bit more plausible when you and Ed were talking about the boom in the 1990s.

**McGrattan:** But they have to think of it as relative to a trend, right? Because remember, this is not saying that productivity is going negative; it's that the growth is slowing.

**Andolfatto:** That's quite a bit more plausible, right? I mean, as opposed to actually estimating that productivity contracted by 5 or 10 percent.

**McGrattan:** Right. They would say: "Wow, you're throwing out the blueprints?" No, we're not. But, of course, there are factors that are negative. If you make firms fill out lots of paperwork, that can make TFP growth negative.

**Andolfatto:** So this is interpreting the TFP a little more broadly to include regulatory burden, for example?

**McGrattan:** Because that's what we're going to pick up.

**Andolfatto:** I heard you mention that one of your lifelong goals is to develop a framework suitable for policy analysis. And we've been working at this a long time. I've been seeing this model become richer and more realistic and better.

Does the model, the competitive equilibrium in your model, model government regulations necessarily?

**McGrattan:** No. There's nothing that impedes competition.

**Andolfatto:** So the recent crisis we went through was completely efficient. It was just a by-product of a slowdown in productivity growth?

**McGrattan:** That's a good question. A lot of people think there were some disruptions in financial markets. That may well be. The baseline model that they'll typically use to analyze the economy and build on is the baseline without the intangible investments included. That model economy has no chance of accounting for what we recently saw.

What I'm trying to do is develop a better baseline model, one with competitive markets, no frictions, no disruptions. This is what I presented today. I want to set a higher bar for people who would say: "I've added something to the standard model that does much better in accounting for the data." My response is: "I want you to start with my baseline model. Then, add to that baseline model the financial disruptions that you see in the U.S. economy." It would be nice to know how much of the aggregate fluctuations are due to factors that the government can't fix.

The government could fix some regulatory issues—no doubt about it. But if it's about how much we're getting out of scientific progress—those ebbs and flows in scientific progress—there's nothing that the government can do about that.

We have to be a little bit skeptical when people say we now need the Fed to do this or that. Or now we need Congress to do this or that. We have to know what the policy will do in a decent baseline model that fits the data well.

**Andolfatto:** I noticed from the graph the estimated fit to the actual data. Your model-to-data fit looked really, really tight.

That's just basically ascribing zero role to financial market frictions in the recent episode.

**McGrattan:** Unless they manifest themselves as changes in TFP.

**Andolfatto:** Most people are just going to say this is crazy. So what do you say to them?

**McGrattan:** I would say that if you think that the financial frictions had some impact, it's very likely going to show up as a misallocation of factors across sectors. What we see when people theorize about the financial crisis is that it shows up elsewhere—as in something that affects investment decisions across time.

I'm saying no, look elsewhere. If your financial frictions are having an impact on the aggregate economy, it's very likely that they're having an impact by misallocating factors across sectors. So that's where I would look if I were going to make the case that it's financial disruptions. Look at the sectors. Look at misallocation of capital. Look at misallocation of labor.

**Andolfatto:** Think about an aggregate demand shock, a shock that makes everybody more frightened, more risk averse. They're less secure about investing in private label collateral objects. Instead of going out and spending their money, they invest in government Treasuries, for example. And so there's an aggregate portfolio substitution out of financing private capital into, say, government bonds. To an econometrician, this would look like a sudden collapse in private investments. Not a sectorial thing. An aggregate decline.

**McGrattan:** Right. And there's clear evidence it's not that.

**Andolfatto:** That's the evidence that is telling you that, given that if you take into account the intangible capital properly?

**McGrattan:** Right.

**Andolfatto:** I admire you for carrying on this fight. We have to challenge people.

**McGrattan:** They have to confront the facts. And I welcome disagreement. Models can be horse-raced.

I would like to raise the bar. I would like anyone who is ready to take on the standard competitive model to compare

their model predictions with the Bureau of Economic Analysis data. Take their model, do the statistical analysis that I'm doing. I would welcome that because then it'll be very clear how well those theories do vis-à-vis the data.

**The paper's main takeaways, according to McGrattan:**

- This is still a work in progress. There's a lot to be done. What I've done is looked at cyclical movements. I'm still thinking about how to deal with trends. When we think about intangible investments, think back to 1980. In 1980, there was no software industry, there was no Internet. So there's more to be done in the area of modeling changes across time.
- I would like people to update their baseline model instead of saying: "Hey, my model can beat the baseline model of the 1980s." We know that baseline model is going to fail along certain dimensions because it's not taking into account intangible investments that people have estimated to be as large as tangible investments.

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## Lee Ohanian

*University of California, Los Angeles*

### “Neoclassical Models of Aggregate Economies”

**David Andolfatto:** Why don't you tell us what are you talking about here in your paper, “Neoclassical Models of Aggregate Economies”? What's this paper about?

**Lee Ohanian:** It's actually a really simple idea. The idea is that economies are always being hit by various kinds of shocks. And two of the biggest shocks that we can think about are shocks to technologies and shocks to government policies—fiscal policies, government spending, tax rates, regulatory policies. The technology shock could be something like the development of the microprocessor or the development of the Internet. It could be something like a change in the weather, such as the drought in the western part of the United States.

Economies evolve and respond to these shocks through market processes. And in doing so, we see movements in how many people are working, how much people consume, how much firms invest and how much is produced. The idea in this paper is to look at just two factors: changes in technologies, which have been such a big part of our lives, and changes in government policies. And we examine only those factors that are really long lived, such as the Internet or income taxes, which began in 1914. These are large, permanent changes in government policies and technologies.

How we learn about the actual economy, as you know, is we simulate model economies. We simulated a variety of model economies in which markets function very well. That's what we mean by a neoclassical model.

Then we asked, “How did those model economies respond when we look at changes in technology and changes in government policy that we can measure using data?” And then we asked, “To what extent do the movements in the model economy correspond to actual movements in the data?”

**Andolfatto:** I gather from the approach you take here that this is a bit in contrast to the traditional business cycle approach, where at least in the last 20 or 30 years, we were more interested in what we call higher frequency movements in the data. It seems here what you're trying to do is try to

take the same modeling framework and see to what extent it can account for broader swings, lower frequency. Is this a big departure from what has traditionally been done? Is this something that's important, to look at the lower frequency movements?

**Ohanian:** It is a departure. As you mentioned, the traditional approach was to assume there were two pieces to economic data: There was a very smooth trend, and there was what we call the business cycle—movements that were very, very short-lived.

But what we show in this paper is that there's a big part in the middle that's not very short run and that's not super long run. And there's a lot of movement and data that correspond to what we call these middle frequencies.

To us, it makes a lot of sense, because when you think, “OK, the Internet's invented. There's a new technology,” or, “The microprocessor's invented,” those innovations are going to take a long time to evolve and disperse through the economy. We should expect to see things like the development of the Internet or the development of the microprocessor, the development of smartphones, to have an impact on the economy that lasts five, 10, 15, maybe 20 years or even longer.

What we see in the data is that the movements that correspond to those 10-, 15-, 20-, 25-, 30-year cycles are very big. In fact, they're bigger than the movements at the business cycle frequency. What really surprised us is that, today, the business cycle frequency movements are almost all gone. The remaining movements are these 10-, 15-, 20-, 25-year movements.

**Andolfatto:** Another characteristic or benchmark of your modeling approach is that you are beginning with the hypothesis that markets work relatively well on their own. That might strike a lot of people as odd, especially at higher frequencies where we think that the business cycle is often, at least in part, a manifestation of markets not working so well at times.

I suppose, given your emphasis on the longer horizon, do you think that this view might be more acceptable and it's



more justified or something like that? Oftentimes people think markets don't work well in the short run, but in the long run they work things out.

**Ohanian:** A common view toward thinking about business cycles is that there are changes in monetary policy, and the dollar price of goods and services doesn't respond immediately in response to those changes in monetary policy. The fact that the dollar prices of goods and services don't change immediately perturbs the economy in particular ways. By looking at these 15-, 20-, 25-year movements, that's plenty of time for dollar prices of goods and services to change, for the wage rates of workers to change and for search behavior of workers to sort itself out.

When you think about the market process in advance, like the United States, you look at these long-run episodes we used to have: 80 percent of the workforce was in agriculture in the 19th century. At that time, we needed 80 percent of our workers in agriculture in order to feed ourselves. Today, it's about one-half of 1 percent. The market processes evolved to move those workers out of agriculture to produce manufactured goods as well as services.

So when we look at these long-run issues, we think market process is incredibly powerful for understanding movements like from agriculture to manufacturing and services. We think that these longer-run movements are exactly what the doctor ordered for thinking carefully about the usefulness of modeling markets that function well.

**Andolfatto:** There are many episodes—not just in the United States, but in other countries—where the countries enter into these slowdowns or these phases or even great depressions or lesser depressions. It's probably a bit difficult to reconcile with the notion of new technologies, though not impossible, I suppose, if the new technologies are disruptive. But there must be some other hypotheses at work here to account for these episodes. What was responsible for the recent crisis through the lens of your modeling framework?

**Ohanian:** Let's start with Europe. We look at data from Europe, and again, we use this particular decomposition in which we separate the data into these different pieces. Some pieces are what we call very short movements associated with the business cycle, and then these longer movements are 15-, 20-, 25-year movements.

In Europe, what we find is almost all of the movement is due to these 15-, 20-, 25-, up to 50-year movements in the data. There's hardly any movement whatsoever from what we

would call the business cycle. This is really important, because it is at the business cycle that we think monetary policy would be the most important. That's a case in which markets that don't work perfectly, such as wages or prices that don't adjust instantaneously, are going to be relevant. In Europe, you see virtually no business cycle fluctuations. It's all due to these long-run movements. Then you combine that statistic with the fact that many European countries—including Spain, France, Germany, Italy—have had almost no productivity growth in the last 35 years, and that's a remarkable fact, because you think about the Internet, microprocessor, all of these things have transformed our lives.

I think what may be going on there is that Europe has adopted a lot of regulations, a lot of restrictions, that actually ironically make markets work less efficiently—restrictions on labor and labor mobility and hiring restrictions and firing restrictions. Venture capital is very difficult to access in Europe.

A lot of regulation protects incumbent businesses at the expense of entrance. A great example is in France. France banned Amazon from free shipping. We have Amazon Prime, we click on the icon and make our order, we get the product in two days, and there's no shipping charge. You can't do that in France. Why is that? The local bookstores lobbied the French government and said, "Hey, we can't compete." So France passed a law saying, "OK, Amazon, you can't have free shipping." So you see lots of these regulations in Europe. There's some research I'm doing with Jesus Villaverde, who's at the University of Pennsylvania. We're looking at this issue.

What I conjecture is that these types of government policies that impede and suppress the competitive forces, which are so important in a market economy, are responsible for why productivity growth has been so low in Europe. When viewed through that lens, the crisis in Europe almost looks like a manifestation of what's been brewing for a long, long time. Economists and policymakers look at Europe and focus on debt crises, such as the problems that Greece is having, but that didn't come out of nowhere. I think that's been a long time brewing.

**Andolfatto:** Your model ascribes absolutely no role to financial market frictions or debt overhang. Oftentimes, we abstract in our models to get at what we think are more important forces. But do you think that—in light of the evidence, say, by Carmen M. Reinhart who suggests that following major financial crises, economies stagnate for quite a bit of time—there is an effect through deleveraging and things like that? Would it be fair to say that your model is identifying different forces at work that has either nothing or very little to do with debt deleveraging or financial market frictions?

I THINK WHAT MAY BE GOING ON THERE IS THAT EUROPE HAS ADOPTED A LOT OF REGULATIONS, A LOT OF RESTRICTIONS, THAT ACTUALLY IRONICALLY MAKE MARKETS WORK LESS EFFICIENTLY—RESTRICTIONS ON LABOR AND LABOR MOBILITY AND HIRING RESTRICTIONS AND FIRING RESTRICTIONS. VENTURE CAPITAL IS VERY DIFFICULT TO ACCESS IN EUROPE.

**Ohanian:** The model we have as of now is one in which financial market imperfections and debt deleveraging is not playing a role. You're absolutely right: It identifies different forces and identifies forces that are moving in big ways that economists and policymakers haven't discussed very much. One of these issues is productivity growth, which is really what this model is all about, and it has been slowing down for a long time. Productivity growth seems related to entrepreneurship activity and startups.

If I can have a moment: If you think about job creation in the United States in an average year—not a recession, but in an average year—if you just mechanically take away the startups and add up all the jobs created and all the jobs lost, then the U.S. economy actually loses jobs just from all the incumbents. If you look at gross job creation, startups and rapidly growing young businesses account for about 60 percent of job creation. So that's really where the action is in terms of a growing economy.

But entrepreneurship rates are down 35 percent today relative to where they were in the 1980s. In the U.S., a lot of what was going on in the financial crisis, I don't think it's just like we snapped a finger and suddenly Lehman Brothers came down and we had the problem with AIG and then all heck broke loose. I think that the underlying economy was weakening long before that, reflecting a significant drop in new business formation.

That's not to say financial issues were unimportant. But the longer our economy continues to be below its pre-2007 trend and hasn't made much, if any, recovery whatsoever to that trend, I think the Great Recession is going to fade out of view. And the big question becomes: Why aren't we recovering? It's been seven years now, and productivity growth is 0.9 percent as opposed to 2.5 percent average. Employment population rate is way, way down.

**Andolfatto:** Is it a bit of a tough sell for people out there? Your model emphasizes productivity, and I think most people out there would accept that productivity movements influence the

longer-term movements of the economy. But people must come up to you and ask you, "Are you really serious?"

Do you really believe that it was a productivity event or accumulation of development of either sectorial or aggregate productivity that was somehow responsible or perhaps in conjunction with a set of government policies that was responsible or could account for the recent Great Recession, the financial disruptions? Everything that the Fed worries about and that government policymakers worry about really suggest that they truly believe something is still amiss in terms of financial markets. How do you really persuade people about this stuff?

**Ohanian:** There's really two issues. One is the crisis and the rapid drop in employment that occurred in the first three or four months of 2009. Other things are going on, absolutely. But what I'll ask people is to step back and say, "Okay, what are by far the most important determinants of long-run living standards?" And people will say productivity, absolutely, no question whatsoever. I said, "Well then, let's work ourselves backwards. How about at 30-year levels productivity?"

Then we can have that conversation. At some point you're going to say, "Well, okay. Productivity's important. It's always important. Maybe it's more important at 10- and 20-year horizons than one- or two-year horizons. But it's there." Then I'll tell people, "Let's take a look at what's happening to information technology productivity growth."

That's been really such an important force in driving the economy in the last 30 or 35 years. You think about Apple, Google, Microsoft really transforming the world and the economy. What we're seeing is far fewer startups in IT, far fewer successful startups in IT, successful startups meaning businesses that grow at least 25 percent per year in terms of employment for at least five years.

Of those that have that rapid growth rate, there are far, far fewer that are really taking off the way Apple did or Microsoft did or Google did. You look at that statistic, and that's a grim statistic. I think a lot of people who have thought this was a financial crisis, and even with Reinhart-Rogoff, thought we should be having some recovery by now. We're not seeing recovery.

You look at businesses, and as you know, they're cash rich. The corporate sector has enough cash on hand or more cash on hand to finance all the investment that they need to do. So the current economy is a puzzle, I think, from a lot of perspectives. I think it's particularly a puzzle for those who look at financial forces as being the be all and end all. If that was the case, then you'd say, "Well, why haven't we gotten back? These businesses have tons of cash. Interest rates are close to zero, at

least on government securities. Why aren't they investing?" My response would be: "It's an underlying economy that's not nearly as healthy as one we used to have."

**Andolfatto:** A lot of people point to those same statistics as evidence that the financial markets are impeded in some manner. Firms don't typically hold that much cash unless they want to build up a precautionary saving. We know that imperfect financial markets are what cause a buildup in precautionary saving.

So the evidence that they have cash is actually indicative that they're fearful of something: future borrowing constraints or future finance conditions. You mentioned real interest rates on U.S. short-term Treasuries are -2 percent. Inflation is very, very low. It just sounds very strange. It may be coincidental or symptomatic of a deeper problem is what you're suggesting?

**Ohanian:** Take a parallel of something like Japan. Japan's had very slow economic growth for a long, long time. They've had such low inflation, occasionally deflation. Not particularly severe deflation, but some deflation. Interest rates are near zero. There are some economists, I think, who have the view that, if we could just pop up inflation from zero to 3 percent in Japan and get them off that zero lower bound, that would pretty much bring back prosperity to Japan.

I look at Japan very differently. I look at Japan as a country with an aging labor force, very low birthrate, no immigration, very low entrepreneurship. Low entrepreneurship means few startups. Few startups means few successful startups. Few successful startups means very few new engines of economic growth. So when I look at Japan, I think going from zero to 3 percent inflation is not their panacea.

So the data that you mention can be interpreted in different ways. For those who think financial markets are really what's holding the U.S. economy back, I would say the questions have become: "Why? And when will it turn around?" The Reinhart-Rogoff evidence doesn't say this continues forever, but I don't see much signs of recovery. And I do see very little productivity growth.

**Andolfatto:** The same question could be asked of you: When will productivity growth turn around? We can't make those forecasts. We can only remain hopeful that it will, I suppose. And I guess government policy in your model, strictly speaking, takes quite a *laissez-faire* approach.

What sort of practical policy implications could you recommend—at the federal level or lower levels—in order to get out of this funk that we're in?

**Ohanian:** We talked about entrepreneurship and startups. Successful startups are disproportionately done by immigrants. 45 percent of the Fortune 500 was founded by an immigrant or the child of an immigrant. And we have severe restrictions on immigration, a lot of which go back to the 1980s, many of which are country-specific quotas.

So I think the simple answer is reforming immigration, particularly for highly skilled workers. We have these people that come here and that study at Stanford and MIT and Caltech, and they get PhDs in computer science and electrical engineering.

They want to start businesses here, but we make it hard for them to do that. Congress understands this, and there are bipartisan-supported bills in both the Senate and the House aimed at bringing in more immigrants who want to start businesses. Based on my reading of the data, if I could think of one policy, it would be that one. And it's heartening for me to see that Congress understands that and they're trying to move forward on it.

**Andolfatto:** Very good. But I'm going to ask just one question. Is there a role for government in any dimension in terms of doing good things for building—not just promoting growth by removing restrictions that they've imposed? Perhaps infrastructure spending or whatever. I'm just curious to know what your thoughts are.

**Ohanian:** If you went back to President Obama's American Recovery and Reinvestment Act, a part of that was for infrastructure investment. The president talked about shovel-ready projects, and there's not so many shovel-ready projects on at any point in time. Only about 3 percent of the ARRA went towards infrastructure investment.

Now you look at the American Society of Civil Engineers. They grade the country's infrastructure every year. The grade they give it is D.

You think about all the resources that we have in this country, and our infrastructure is crumbling. So massive investment in infrastructure, based on what civil engineers think about how adequate our bridges and airports and roads are, I think would be called for.

Government also plays an incredibly important role in trying to make sure the playing field is level and in trying to make sure that we have competitive markets where everyone has the chance to compete. This goes right to the heart of criticisms about "crony capitalism." A lot of what I think people sometimes worry about involves them saying, "That industry or that guy is getting a subsidy or benefit, and I'm not getting

that subsidy or benefit.” So I think governments that level the playing field enhance competitive forces, and those are really important things for governments to do.

**The paper’s main takeaways, according to Ohanian:**

- The big-picture summary is that a lot of our economic historical record can be reasonably well understood within the fairly simple mechanics of supply and demand, and there are times when various forces interfere with supply and demand. Sometimes forces depress output or depress competition, which results in depressing output and trade between people. There are some government forces that might impede productivity growth, such as restrictions on immigration of highly skilled workers.
- We can learn a lot about our economic record in terms of its success and its limitations based on a careful reading of the historical record of economic policies. We can put those through the lens of pretty simple economic models and learn a lot about that.

To watch the interviews from the conference, visit <https://www.stlouisfed.org/connecting-policy-with-frontier-research/2015>.



## Edward Prescott

*Arizona State University*

### “Monetary Policy with 100% Reserve Banking: An Exploration”

**David Andolfatto:** I’m a little surprised to see you get into monetary issues, given your reputation to abstract from matters financial and monetary. You’ve very much focused on what we might call real factors. What motivated this line of research?

**Ed Prescott:** Over the years, I have done a few things in the monetary area. It’s an interesting and difficult area. What motivated this investigation was the monetary policy questions people were asking. I didn’t have the slightest idea as to the answers to these questions, and I didn’t see that anybody else had good answers.

I felt there was a need for more investigation of this in a serious way that matches in close with the way they do it in the national accounts and balance sheets, the way data are reported. Some facts were puzzling for conventional theory.

**Andolfatto:** I guess a lot of people have been asking questions, especially since the financial crisis we’ve just lived through. I presume that that’s what’s been motivating these questions that you didn’t have good answers for?

**Prescott:** You see so much in the news about, “Should we increase the interest rate? Or should we have an inflation rate target?” And people’s answers are not based upon strong theory.

**Andolfatto:** The monetary crowd would have called this a form of narrow banking, where the demandable liabilities issued by financial institutions would have to be backed 100 percent with some form of cash. It’s a very old idea, and people have largely promoted it as a remedy to prevent what they perceive to be bank run phenomena. What are you doing here that’s complementary to or different from what people have done so far?

**Prescott:** Many say or think that there were problems in the financial system that gave rise to the Great Depression. We’ve looked at that in a systematic way using modern theory. And we found that businesses had all kinds of money to invest,

and they didn’t. They increased distributions to owners. Why? The answer is that businesses did not perceive they had profitable investment opportunities.

I don’t think financial crises are a big deal. Tom Sargent, along with others, examined the U.S. financial system in the 19th century. There were numerous financial crises in that century. There was a long period where there wasn’t any central bank. During that century, the U.S. economy grew at a healthy rate in spite of repeated financial crises. It became the richest industrial economy in the world as measured by living standards.

**Andolfatto:** Let’s take a look at that history. I’m thinking of economic historians, like Gary Gorton in particular, who have pointed out the U.S. national banking era from about 1863 to 1913, the founding of the Fed. That was an era of great prosperity for the United States in general, also generally a deflationary episode as well. Nevertheless, that era was punctuated by several rather severe business cycle episodes. And many of them were associated with financial crisis, banking panics and what people have labeled bank runs.

Even though there was no lender of last resort or Federal Deposit Insurance Corporation, no central bank, as Gary has pointed out and others, there were nevertheless what you might call central bank-like interventions, in the sense that prominent bankers like J.P. Morgan would coalesce the banking sector, suspend redemptions, issue clearinghouse certificates, and essentially operated what looked like private sector lender of last resort operations. So these episodes were associated with disruptions in payments and a large loss in output.

There was a general perception that, rather than relying on the private sector to serve in this role, we might need something like a central bank. Are you arguing that these panic episodes were essentially symptomatic to other things? I mean, businesses fail in a crisis. That’s just the natural thing that happens during a recession. Is this desire for a lender of last resort facility, together with a fractional reserve banking system, misguided?

**Prescott:** The facts you cite are correct. The nature of the fluctuations was well documented by Milton Friedman and Anna Schwartz in their *Monetary History*. You'd see their measure of money supply—they called it M2, which is checking plus savings deposits at commercial banks—go down maybe 10 percent. And a little bit later, output would go down 10 percent. And then convertibility was suspended the ways you described. Businesses figured out ways to carry out transactions in these towns. The economy's output and the money supply recovered within six months.

Currently, we're depressed about 10 percent or 12 percent relative to pre-2008 trend on a per capita income basis, and this has been for six or seven years. In the Great Depression, it lasted for 10 years, and the depression was 25 percent. It was not a matter of the payment system being disrupted for the entire decade.

The mortgage markets went out of existence, virtually, in 1981 when there were very high interest rates. Remember 18 percent interest? That's when we made the payment at the last minute. The year I moved from Carnegie Mellon to the University of Minnesota, I had to sell a house in Pittsburgh and buy one in Minneapolis. The financing was not through the banks. I issued a mortgage to buyers of our Pittsburgh residence, and the people that we bought a residence from in Minneapolis provided financing. Once things settled down a couple of years later, we refinanced with a mortgage issued by the banking system. This arrangement diversifies some idiosyncratic risk.

**Andolfatto:** But if I'm understanding you correctly here—maybe I'm not—it sounds almost like you're suggesting that this fractional reserve banking system really didn't do much in terms of creating the downturn or propagating the downturn. If that's the case, then why this radical proposal to impose 100 percent reserve banking? Is it solving a problem that doesn't even exist?

**Prescott:** Rahm Emanuel said, "Don't waste a crisis." When there's a crisis, government uses it as an excuse to do things. They used this one to put in a lot of policies that depressed real output and depressed productivity.

**Andolfatto:** You're suggesting that they should have used this crisis as an opportunity to pass a radical banking reform?

**Prescott:** No. Scandinavian banks all went bankrupt in 1992. They instituted good reforms, and their economies did well afterwards. They did not waste their crisis. Japan had a crisis at the same time. They instituted a bad policy regime and lost a decade of growth.

**Andolfatto:** The recent banking crisis was not centered in the retail sector. We have the FDIC, the Feds there. Retail level bank runs in the United States have been a thing of the past since about 1933. Are you specifically thinking more shadow banking sector reforms here in this paper?

**Prescott:** I don't want a financial crisis to give people excuses to institute a bad policy regime. When I say policy, I think people should get together, examine it and think long run, not what will happen tomorrow. We want a good set of rules to follow that facilitate an efficient payment and credit system that's sound. That's valuable. With the new technologies, this system is going to change. And we want to have a better one to institute. Our financial systems have been getting better.

**Andolfatto:** I guess there's two dimensions to the financial system. One is the payment system. And I think you're absolutely correct. There's been rapid technological change in this space that's permitting more efficient, more secure payments. We also see this really wild innovation out there in the cryptocurrency space: Bitcoin, the blockchain, the potential applications. So there's that element.

But apart from facilitating payments through the banking system, banks also perform other functions. Maturity transformation is a classic one. The Diamond-Dybvig model is a classic formalization of this notion that banks actually perform a socially useful role, but that requires fractional reserve structure, the issuance of highly liquid demandable liabilities.<sup>1</sup> If everybody exercises the redemption option simultaneously, there's just not enough reserves in the system. You end up in fire sales and the payment system disrupts, etc.

Where do you see this paper fitting in and contributing? Is it on the payment side? Let's take seriously the new technologies that are there. Let's permit everybody to have an interest-bearing account, either directly or indirectly, with the Federal Reserve. Or do you see this prescription more dealing with the ills that you see with fractional reserve banking systems?

**Prescott:** The transaction part of the financial system is a small part of the system. The major functions of the financial system are to channel our savings for retirement into investments in productive assets, to not use up a lot of resources in the process and to diversify idiosyncratic risk that averages out. Our system has gotten quite good in these regards. I'm worried about the transaction part being the tail that wags the dog and want to separate that out in a nice, simple, clean system. Only a small part of commercial banking activities is tied in with that transaction.

Most of the assets under management are in trust, where people put up their money and finance a project, and many take a little piece of a number of those projects in order to diversify risk.

But there's a time inconsistency problem of policy. It seems that governments, if there's a financial failure, bail out the lenders. Who ends up paying for this bailout?

There is a lot of U.S. money abroad. I talked to the former prime minister of China once in 2005. Everybody was yelling about them holding huge amounts of U.S. dollars as reserves. I said, "If you want to make it cheap for me to borrow, I don't mind."

Some people estimate half our national debt of about an annual GNP, which is a big number, is held by foreigners. The Chinese economy is getting too big to peg their currency using foreign reserves, which are mostly U.S. dollars.

**Andolfatto:** In terms of the moral hazard issue that you raise, I think that's true. But it's probably not specific to banking per se. There is a tendency for special interests to ask for the handout. One thing that's true under 100 percent reserve banking is that there would likely be no need for FDIC, for example. The deposits would be 100 percent insured. And this is including very large deposits. There's no need to bail out.

**Prescott:** There'd be no need to bail out with a 100 percent reserve system. Whenever there's a transaction, somebody's account gets credited and somebody's account gets debited by equal amounts. Before the exchange, you can make sure that that person making the payment has sufficient deposits.

**Andolfatto:** It's an attractive idea that way, and there's a long history promoting this idea. Now I want to spend just a little bit of time talking about the formalism that you used in your talk. You developed a mathematical model to introduce this issue of evaluating the costs and benefits of a 100 percent reserve banking system, a narrow banking system. What was the purpose of formalizing it in this way?

**Prescott:** To begin, the purpose is to develop better intuition as to whether inflation rate targeting is good. All the big central banks seem to have gone to the 2 percent target. Should we focus on inflation rates or interest rates? There's debate as to this question. And does this make sense?

We want to have each of our sectors be more efficient, and this is just one sector in the economy.

**Andolfatto:** Well, one sector that interlinks several sectors in the sense that it performs the bookkeeping, and a lot of people have argued that it's a very important sector. Another way to phrase my question is that there's already a large body of models out there that attempt to address these types of issues. Maybe there's something you find unsatisfactory about the existing body of research? Or did you just want to explore a slightly different tact?

**Prescott:** The tradition was to focus on the traditional bank, the banks that would take deposits and lend to businesses. The major places where people put their savings were in banks, in insurance companies through whole life insurance—which was really a pension plus life insurance—and in state and local government debt. That was pre-Federal Reserve period. People would hold that debt to maturity.

But now things have gotten more complicated, and the system works quite well. It can do so much. Things get pooled and averaged out. When I issued a mortgage, I was nervous. I bore a lot of idiosyncratic risk. I could lose a lot if some misfortune fell on that family. But if you hold a small part of a large number of mortgages, this risk gets averaged out.

**Andolfatto:** Those elements of risk sharing are there in some older models as well. But are you suggesting things have changed in a manner? Technology has progressed where it's worthwhile to leave that older class of models and explore different avenues?

**Prescott:** The financial system has been getting better. And the spread between borrowing and lending rates has come down. We as a household like to borrow at a low interest rate, and we like to lend at a high rate. The spread between those two has shrunk since the '60s.

**Andolfatto:** Every person who studies this question of banking design and monetary policy the way you do here has to address the question of how the monetary policy and fiscal policy interact. Does it even make sense to speak of monetary policy without at least being explicit about what's happening on the fiscal side?

**Prescott:** Within a range you can, but Venezuela and Argentina, for example, are not in that range. Lots of countries have high inflation. Russia, Iran, Brazil inflation is 10 percent, and those other countries 20 percent.

That's really a fiscal theory of the price level it comes down to if you start using the monetary system to tax through "the inflation tax."

**Andolfatto:** Do you think that's the case for the United States? There is this huge worldwide demand for U.S. Treasuries. With the yield on U.S. Treasuries so low, they practically look like Federal Reserve liabilities. But these Treasuries are issued not by the Fed. They're issued by the Treasury. So what does it mean to conduct monetary policy without reference to what's happening on the fiscal side, even in the United States, never mind Venezuela?

**Prescott:** In this paper, I tried to keep it as pure monetary policy as possible. It was impossible. Because a constraint is that government expenditures equals its receipts plus change in government debt.

**Andolfatto:** It follows from the consolidated government's budget constraint, in other words.

**Prescott:** Yes.

**Andolfatto:** I know this is a preliminary investigation and just a paper to stimulate discussion. But when you were working on the model and performing some policy experiments, did you discover anything surprising in the model?

**Prescott:** One thing was satiating businesses with money. Money is virtually costless to produce. The Fed only pays for the printing cost and the transportation cost. Given that it's virtually costless to produce and it contributes and facilitates the businesses entering into more productive contractual arrangements, Friedman satiation makes sense. With a 100 percent reserve system, there can be satiation with inflation.

**Andolfatto:** The idea of satiating individuals or businesses with liquidity sounds very much like the Friedman rule.

**Prescott:** He proposed satiation. He's one of the first to propose it. The Friedman rule said to deflate at the real return on capital.

**Andolfatto:** That was in the context of zero interest-bearing money.

**Prescott:** That's why the interest-bearing currency was a big difference.

**Andolfatto:** You want to equate the rate of return of money with other safe assets?

**Prescott:** Yes, and keep it simple for people. Don't make businesses have to guess what the inflationary policy is going to be, so they can worry about producing more efficiently.

**Andolfatto:** Give them a nice, safe payment system. No need for federal deposit insurance. And ...

**Prescott:** There's lots of regulation. There's no new banks being created recently.

**Andolfatto:** Right. Interest-bearing accounts for individuals, either directly with the Fed, or maybe an account through the intermediary.

You spent a little bit of time discussing possible problems with this system. One thing you said was: "Before initiating the system, one would need to consider, among other things, privacy protection and shadow banking." What are your concerns here?

**Prescott:** Currency can be pretty anonymous, and privacy is important. We've got to protect that. It's a difficult thing to handle, because some governments have been known to abuse that, and some private agencies too. Data breaches are a problem.

**Andolfatto:** What can we do about shadow banking? You know how clever bankers are. It seems like the whole shadow banking sector exists just to bypass existing regulations. Do you think this type of proposal would eliminate shadow banking to some extent? Or would it push more business toward shadow banking? You see it as a substitute?

**Prescott:** They would carry out the transaction with a little smaller spread between the interest rate in these worlds where there's just two interest rates, which there's not. There's all kinds of interest rates. Which one you're referring to is ambiguous. And a lot of resources are used up in that sector of the financial system.

**Andolfatto:** The defining characteristic of banking and shadow banking is the mismatch between the asset and liability structure.

**Prescott:** There are financial clearinghouses which carry out huge amounts of transactions. The amount of transactions in dollar terms carried out in a day is something like 60 percent annual GNP, and most of this is done by the clearinghouses.



Clearinghouses did not get into trouble in the recent crisis. All these transactions contributed to making the market more nearly efficient and increased liquidity of traded assets. The bid-ask spread on publically traded stocks has gone down virtually to zero. I think that this is evidence of improvement in the transaction system.

**Andolfatto:** You also had a slide in your presentation on a possible solution to the shadow banking problem, and one of your bullet points is intriguing. You suggest taxing net interest income at a 100 percent rate for limited liability businesses.

**Prescott:** All households are a household business. I want to let them lend money at positive interest and not have the interest income taxed at 100 percent. That is why I propose the 100 percent tax on net interest be imposed only on limited liability businesses. The households are what are important. They really own all private property either directly or indirectly. They own the firms that own the assets. Or sometimes they own the firm that owns the firm that owns the firm that owns the assets and incurs the liabilities. What I want is to get rid of limited liability gamblers who borrow at low interest rates and lend at high rates.

**Andolfatto:** This is profound. Ed Prescott is suggesting that a tax rate out there is too low and that the appropriate tax rate is a 100 percent.

**Prescott:** It's on a particular type of income, net interest income these gamblers make. And then they've got to be limited liability, so losses are borne by the taxpayers. The lenders to them get bailed out by the taxpayers. If there is 100 percent tax on net interest income, there will be no financial intermediaries borrowing at a low rate from one set of agents and lending to another at a higher rate. This tax on net interest income is designed to eliminate shadow banking, not to collect taxes.

**Andolfatto:** Do you actually experiment with these tax reforms in your model?

**Prescott:** Maybe a 100 percent tax on the net interest income of limited liability businesses would not eliminate this gambling. If it was imposed, maybe financial experts would figure

out a way to get around it. That's one of the reasons I put it on the table.

#### ENDNOTE

<sup>1</sup> Diamond, Douglas W.; and Dybvig, Philip H. "Bank Runs, Deposit Insurance and Liquidity." *Journal of Political Economy*, 1983, Vol. 91, Issue 3, pp. 401–19.

#### The paper's main takeaway, according to Prescott:

- I'd like the theory to advance to provide better guidance to the design of a better system. There'll be some benefits to the people of having a better-functioning payment system.

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