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WHERE INTEREST RATES WILL BE WHEN THE ECONOMY IS (FINALLY) HEALTHY AND WHY IT MATTERS

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Panel Discussion:

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PROCEEDINGS

MR. WESSEL: Good morning. I'm David Wessel; I'm director of the Hutchins Center on Fiscal and Monetary Policy here at Brookings. Our mission is to improve the quality of fiscal and monetary policy and public understanding of it. And we hope to take a step in that direction today.

It's been seven years since the onset of what Ben Bernanke has described as a financial crisis worse than the one that led to the Great Depression. And in the wake of the Great Recession, the disappointing recovery, I think we're confronted with several big unanswered questions about the economy. Why has productivity growth been so slow, why isn't business investing more, why has it been so hard for central banks to get inflation up to their two percent target. I mean when I started covering central banks, getting inflation up was not their major challenge. (Laughter) How exactly does quantitative easing, the trillions of dollars that central banks spend on buying long-term bonds work, or does it work at all? How big a debt can a government incur before it really runs into trouble?

So today we're not going to address any of those questions, but we are going to address another important one which is where will interest rates be when the economy finally returns to normal and why does that matter. Now I suspect to many American consumers and business people that doesn't sound like a very important question. They're probably more worried about what's going to happen to interest rates in December and what's going to happen to the interest rates in the near-term on their savings, on their auto loans, on their variable rate mortgages. But as we'll hear today this question, what is the long-term equilibrium interest rate, is really a very important one, not only to the Fed but to savers, investors, and businesses as well. We'll hear today that there has been a marked decline in this measure over time and we'll ask some questions

about that. Is this a symptom of some economic malaise of secular stagnation, or does it reflect the aging demographics of economies, particularly in Europe and Asia, that have produced a glut of savings that is putting interest rates down. Is this a long lasting trend or a temporary one that will dissipate as we finally recover from the Great Recession? Does this mean that the Fed and other central banks are going to repeatedly find themselves with interest rates at zero, concluding that that's not low enough? Does this mean that governments can safely borrow more than we thought they could? What does it say about the returns that pension funds can expect over the coming decades?

Now answering these questions, which is hard, does require a look at history. It's hard to know where you're going unless you know where you've been. And it also requires some economic models because the long-term equilibrium interest rate, sometimes called the natural rate, cannot be observed directly. There is a wonderful quote in the Williams and Laubach paper from an economist named John Henry Williams. Is he related to you? No? John Henry Williams, who was a Welch economist educated in the U.S., and he said in 1931, "The natural rate is an extraction, like faith it is seen by its works". One can only say that if the bank policy succeeds in stabilizing prices, the bank rate must have been brought in line with the natural rate. But if it does not, it must not have been. So that's why you can't understand what the Fed is doing right now. (Laughter)

Today's event is sponsored not only by the Hutchins Center, but by the Initiative on Global Markets at the University of Chicago's Booth School of Business which originally commissioned one of the papers we'll hear today. This joint venture is a first for the Hutchins Center and we look forward to doing more of this. In fact we've already scheduled our second on in Chicago for November 10 when we'll discuss a book we're putting out called The \$13 Trillion Question, a book that looks at not how much the

Treasury should borrow, but how it borrows. And like this event that event will be webcast, so if you can't make it to Chicago you can still participate.

This morning we're going to begin with a paper that has four co-authors, which is a miracle in and of itself, two from academia, Jim Hamilton of UC San Diego, and Ken West of the University of Wisconsin, and two from Wall Street, Jan Hatzius of Goldman Sachs, and Ethan Harris of Bank of America Merrill Lynch. They're going to talk about the equilibrium real funds rate, past, present, and future. And then Anna Cieslak of the Fuqua School of Business will respond, and my colleague, Louise Sheiner, will come up and have a brief conversation with them. And if we have time we'll take some questions from the audience.

After that we're going to hear from John Williams, President of the San Francisco Fed on a paper he and Thomas Laubach, Director of Monetary Affairs at the Federal Reserve Board, have done, updating earlier work. And we're very pleased that Maury Obstfeld, now the Chief Economist at the IMF will respond to that. I'll moderate that discussion.

And finally we'll turn to the implications of all this in a panel with some of the authors and respondents, and with Anil Kashyap, my friend from the Booth School.

If anybody is moved to Tweet about this we have #Equilibrium. I can only imagine the other things that will show up under that hash tag. It might be more interesting. (Laughter)

With that, let me invite Ken West to come up and present the first paper.

MR. WEST: Thanks, David, and thanks everybody for coming. As David said this is a four author paper. My colleagues, my co-authors are here in the audience and I hope they will join me in following up on any comments the discussant has and any questions you have in the audience.

David framed the question well. The topic is what is going to be the long-run safe real interest rate. Conventional wisdom about the value of this unobservable variable is that it's at a value of two percent. In terms of presenting that conventional wisdom I'm going to turn to the members of the FOMC. But one of the innovations that Ben Bernanke made was he periodically surveys the members of the FOMC and asks them their view on the evolution of some important economic variables. The FOMC members are asked to weigh in on what's going to happen this year, next year, next several years, and in the longer run. Among the variable they're asked about is the nominal Federal funds rate and inflation.

Back when this survey started in January 2012 the view of the members of the FOMC was that the Fed funds rate, once we got out of the soup of the Great Recession, would rise back up to four percent, inflation would hit the target of two percent, the implied longer run value of the safer rate of is therefore two percent.

So the variable we're interested in, the variable we're discussing is this longer run, safer rate. Conventional wisdom at one time had it that this value was two percent. But that's conventional wisdom, that there's a general consensus that that two percent figure is too high and we are going to share this consensus, we're not to contradict this consensus, this consensus that it's too high. We see in the blogosphere punditry, financial markets, and in the FOMC itself. Start with the blogosphere, there's a quote there from Larry Summers, who of course is a believer that we may be in for an extended period of really crummy growth and secular stagnation. If so that's going to lead the Fed to set their nominal interest for a long period of time down to zero he says. Not that four percent figure we saw before but zero. Set that nominal interest rate at zero. You get inflation at that two percent or any reasonable figure, you're not going to end up with at two percent long-run safe real rate, you're going to end up with something

negative. You know, zero nominal interest rate minus inflation. So Summers says that conventional wisdom is wildly wrong.

And natural markets tend to say it's modestly long. If you look at what's happening in TIPS and five to ten years out. Depending on where you look you're going to get a figure not of two percent but, you know, .8, .9, .7 percent, something less than one.

And finally, the FOMC itself has rethought where we're going to end up. So the most recent survey the FOMC and the Summary of Economic Projections happened back in September, members of the FOMC still think they're going to hit their two percent target, but now they think once we get out of the soup in some longer run period, nominal rates are going to rise to 3.5 and implied real rate is going to be 1.5.

All right. So everyone thinks this long-run rate is going to fall. We do as well. Our goals here in this paper are in the end to think about what this safe rate is going to be in the long-run. Along the way we're going to talk about how it's behaved in the past, help us get an idea how it's going to behave in the future.

So our conclusions here, number one, is we don't have this great quote that, you know, you have to faith in terms of what you're finding, but like some religious ideas, maybe they're hard to convey, hard to pin down. One reason this long-run safe real rates, this equilibrium rate is hard to pin down is it's highly variable. If there once was a consensus that two percent was a reliable figure, that consensus is ill advised. At no point do we think this was a constant or near constant nature, it moves around all the time. Finally, it has many determinants. The slide in particular notes that trend growth doesn't seem to be a particularly important determinant and we make that point because there is literature, as I'll discuss later, that turns to trend output growth as a particularly important determinant of the long-run safe real rate. But is there a bottom line in terms of

what the safe rate is going to be in the longer-run once we get out of the soup of the Great Recession. Our view is we have a wide range here. Our view is it's hard to pin down, maybe as low as zero, a little above zero, maybe as high as two. Now that range zero to two is not so much a formal confidence interval as it is numbers we get from looking at this question in a couple of different ways. Partly we look at this in an informal what we call narrative discussion. That discussion looks too intense to find meaner version in the safe real rate and kind of thinks well, maybe it used to be two, arguably it could get back up to two. That's part of our discussion. Then we look at it in a completely different using a formal time series econometrics, using the vector auto correction model that's referenced on the overhead, and that kind of puts us to the lower end of our zero to two range.

All right. That's our bottom line, zero to two. We also put to work this notion that the equilibrium rate is hard to pin down and ask what that implies for monetary policy, and we conclude that that suggests the Fed should delay normalization, should hold off on the inevitable raising of interest rates.

Okay, a bit of overview on methodology. I have a hard time limiting myself to a single adjective to put in front of real rate. Sometimes I'll say steady state real rate, sometimes I'll say long-run real rate, sometimes I'll say equilibrium real rate, sometimes natural rate, so my apologies. In any case, whatever word I'm using, we are thinking, as did the FOMC in that Summary of Economic Projections, where are we going to be once we get out of the soup, what is the longer run value, what is our forecast five or ten or twelve years from now, or that five or ten or twelve is something that is uncertain. For what it's worth, in our one set of estimates, that five or ten or twelve, we pin down as seven years from now. For my fellow economists, let me say that our analysis is reduced form. So the professional economists in the room, when they hear

the adjective equilibrium rate, they may think about output gaps and constants and Taylor Rules and other such things. There's none of that here. We're really looking at correlations and reduced form stuff. And consistent with that, when we try to get a measure of the equilibrium rate, we're not doing anything fancy, we're just taking our data, we're saying the equilibrium rate is a steady state rate. So we take our data and we move to our data sample, taking rolling averages. We're going to be talking about the U.S. Occasionally you'll see reference to international or cross country data. When you do that's really solely to inform us about the U.S.

Okay, that's the prologue. I'm going to skip over a couple of graphs I got here and let's get to the immediate analysis. There are four different things I want to talk about before I get to the conclusion. First part of it there is my comment that there's a literature that looks to trend or steady state output growth as a primary determinant of the long-run real rate. We think that's ill advised. That's II. Second part of it, I'm going to talk about in a pretty informal sense what's been going on in real rates recently, and that's the discussion that's going to emphasize there's many, many factors determining real rates, and it looks like there's some meaner version going on which suggests the upper end of the zero to two percent range seems reasonable. Then we're going to turn to a formal times series analysis, the vector auto correction and that's going to be the part of our discussion that will lead to the lower end of our zero to two percent range. And finally I'll talk about the monetary policy implications.

Trend output growth and the long-run real rate. There is a large literature that ties the steady rate real rate to steady state output growth. In particular, the base line model used by both academic economists and in the policy world has in the short run a proportionality between expected growth and spending and the real rate, positive proportionality. If that happens at each month or each quarter, then you average

over time to get a steady state, you're going to expect proportionality as well. So theoretically that's a central part to our economic models. And there's an empirical literature, in particular a paper by Laubach and Williams who you'll be hearing about later, that argues empirically you get good mileage by focusing on the relationship between trend output growth, by looking at trend output growth to tell us about the long-run real rate.

We're going to do something really simple minded here and we're just going to look at various rolling averages of GDP growth and of real rates in the U.S. and abroad and ask whether there really seems to be a reliable relationship between the two. And we're going to conclude no.

So the paper which I recommend to you, it's on the website here, has a bazillion different graphs and tables and numbers in it. And let me just illustrate the basic idea with one graph looking at post war U.S. in which averaging occurs peak to peak in post war U.S. business cycles. The graph here, on the horizontal access is the real rate, on the vertical access is the GDP growth. Each of those dots is an average over a business cycle from peak to peak. So if you take this 1993 figure for example, the previous peak was 1981 three, that was nine years or 36 quarters before. You average GDP growth over those 36 quarters and get a figure of roughly 3, average the real rate over those 36 quarters and get an average of roughly 5. And the other dots there are similarly computed.

Now this literature says there is a proportionality between steady state output growth and steady state real rates with a positive factor proportionality. You look at that graph and ask yourself, are those two series there positively related. Your eye wants to tell you the answer is no, and what your eye is telling you is right. These don't even line up in terms of sign. Let me get rid of that line. Your eyes also tell you that if

you drop just a single point the 1981 three that's in the lower right hand corner, the sign will change. And what your eyes tell you is correct, the sign will change. Another way of saying this is there's a big standard air in the relationship between steady state output growth and steady state real rates. It's not going to tell you anything particularly sharp.

Well, if it's not steady state output growth what is it? Let me start to transit to our narrative discussion here and also finish up on the noisiness of the output growth real rate relationship by circling three of the dots there. So all three of those dots are for business cycles in which growth averaged roughly three percent. And you see then one of those cycles, the one ending n 1981, the real rate was a little less than one percent. In one of them it was three percent, in one it was five percent. Remember our job, our task here is to think three, five, ten, twelve years from now what's the real rate going to be. Even if we were able to nail output growth over that period, clearly from this picture, that's not going to tell us much about the real rate. Output growth is three percent over the time horizon we're talking about. Sometimes it's been associated with real rates of less than one percent, sometimes three percent, sometimes five percent. You've got to look to other things.

What other things could you look to? Well, our narrative discussion looks to a slew of things. Let me start to introduce that by just noting this 1993 cycle followed the high inflation of the '80s. In terms of following the high inflation of the '80s it's our view that there was a considerable fear about a tail risk of inflation taking off again and investors demanded a high premium, a high real rate. You can't think about real rates over that decade in the 1980s without thinking about trends in inflation for example. Some numbers there. Again to summarize, relationship between trend output growth and trend real rates is really noisy. We think it would be ill advised to focus on that.

Narrative discussion of real rates is next. I began it there with my brief

discussion of the 1990s. That's about as specific as I'll get for the narrative discussion. Let me invite you to look at the paper and see the list of actors that we have adduced as substantially affecting the equilibrium rate at one point or another in U.S. history. Any one of those can and has generated a slew of papers. We I think successfully managed to bring all those into this discussion by keeping our discussion kind of informal using a narrative rather than a formal discussion. The bottom line of this is that we could easily perhaps support -- could certainly support a wide range of equilibrium rates, perhaps up to as high as two percent. In connection with that let me just touch on two points. One has to do with real rates in the last couple of complete cycles, and the second on secular stagnation.

In terms of the first point, we're in the soup, long-run rates are zero, real rates are negative. Are we going to be stuck there forever? Well, there have been previous times when rates have been low for an extended period and we did seem to mean avert to more or less traditional levels. So take the second bullet point there, during the 2000s we were stuck below .3 percent for nearly 4 years, but the real rate ultimately rose to 3 percent. So just because we're here now doesn't mean we're going to be here forever. Well, we need to be here forever if we think we're in a world of secular stagnation. We do not. Instead we think the current situation is more consistent with the aftermath of the financial crisis compounded by some special factors, including the fiscal tightening plus some brinksmanship which we just managed to avoid repeating. So equilibrium rate is affected by a lot of factors. There is some evidence of a meaner version that can push us to the upper end of our two percent range.

Now we're going to take a completely different tact. Narrative discussion looked to a lot of factors, was kind of informal, appealed to mean version. Now we're going to be really narrow, just look at interest rates, be a little more formal. In particular,

we're going to develop a model for the short-term, for the interest rate. It's going to be a bivariate model that will have point and time observations on the U.S. safe rate, using annual data. And it's also going to have the global steady state rate, worldwide steady state rate. We're going to get the worldwide steady rate by computing the steady state rate in each of 17 countries in our sample. We get the steady state rate for each of the 17 countries in our sample, then in each year we order those from high to low and we pick out the median value and that is our global steady state rate.

Here's a picture, the black line is the U.S. real rate annual, the blue line is this global world steady state rate. With it, what's called a vector error correction model. This is a model that is intended to work with time series that are very trendy. I'd ask you to look at the black line there, the U.S. rate. It has been noted in connection with secular stagnation that that rate has been falling pretty steadily for 30 years. That's the fall you see from the late '70s to the present. If you can't read the axis in the back of the room, it starts in 1850 and goes to 2014. So this falling period I mentioned is (inaudible). We know that prior to that 30 year secular fall there is roughly a 30 year secular rise from the late '40s to the late '70s. And prior to that there is roughly a 30 year secular fall from around 1919-1920 to the late 1940s. So it's a series that shows long, slow movements. That's a series that a statistician or an econometrician would say is well modeled with something called the unit roots. That picture also suggests that when the black line gets too far away from the blue line it gets sucked back. That's called error correction in times series jargon. Look at that picture, as model suggests itself, we estimated. Top off the slide are specific numbers for any of you time series nerds in the audience. The bullet points at the bottom, I give the bottom line which is when the U.S. rate is below the world steady state rate it tends to get sucked back at the rate of about 40 basis points for every percentage it's below the world rate. However, there is a lot of noise in that series, a lot,

a lot, a lot, a lot of noise in that series. And in particular standard deviation, the residual is 260 basis points, which suggests year to year this 40 basis points that are being sucked back is probably going to be swamped by noise and might be hard to detect.

Let's put that together to give a forecast. So the black line is our forecast. The first data point 2014 is data, the rest is a forecast. We forecast both the global rate, steady state rate, which is in blue, and the U.S. rate which is in black. Takes roughly seven years to get to steady state, 2021-2022. It asymptotes at .4 percent. So that's our version of this FOMC Summary of Economic Projection. Question -- what is the longer run value of the real rate? This model says .4 percent to be achieved in roughly 7 or 8 years with a big confidence interval, with a big confidence interval. And this accounts for lower end of our zero to two percent range.

Finally, I've been talking about point estimates. That previous graph has huge confidence intervals in the dash lines. Let's talk about the monetary policy implications of those huge confidence intervals of a lot of uncertainty. So there is a literature that notes that when a monetary policy maker is uncertain about what's going to happen it pays to be cautious, to not do much. In the particular context of maybe you're uncertain about the equilibrium rate, about the long-run safe rate, there is the paper by Orphanedes and Williams that argues that it's general prescription, it's general presumption, your uncertain, you should move slowly. It applies in particular to when you are uncertain about the equilibrium rate. So what we do is ask whether this presumption has empirical bite when you use a serious and realistic model of the U.S. economy. And in particular we take the FRB/US Model, which is the official staff model of the Fed, and we ask the question, suppose you are uncertain about the equilibrium rate and you use the FRB/US model to think about what to do, how does that affect what a monetary policy maker does, how does that affect it? Does it have a big effect; does it have a small

effect?

So we're going to, in terms of the jargon that's going to appear on the picture, we think about do you just want to adjust smoothly or would you like to move cautiously and put inertia into the rule? And quantitatively we conclude you certainly do want to put inertia into the rule. So the black line there is the smooth adjustment of the rate that would be appropriate if there was no uncertainty about the equilibrium rate. The green line is what comes from uncertainty. You'll note that you delay normalization. That's to your far left of the picture there. The green line stays at zero for longer and compensated a bit by rising more steeply in the end.

None of that is a reason to delay normalization, at least in my view.

That's not the number one reason to delay normalization. Here are a bunch of other reasons. I have to say, we first presented this paper in February. This slide is unchanged from February (laughter) -- unchanged, so there's still a bunch of reasons to delay normalization. The labor market, inflation, the risk to global growth.

There you have it. Thank you. (Applause)

MS. CIESLAK: Okay. It's a pleasure to be here to discuss this paper. Ken did a fantastic job talking about the key results in the paper. The question couldn't be more timely. What is the value, the level of the equilibrium real rate or natural rate. And they estimate it to be between zero and two percent. They find little support for secular stagnation view that the natural rate is going to stay low for an extended period of time because of weak growth.

So I will talk about three comments. I should say that I am in broad agreement with the conclusions of this paper and I will just provide some additional evidence on the results that the authors reached. I will talk about the distinctive properties of real rate implied by the models that we estimate as econometricians versus

what private sector thinks and what policy makers think in their forecast. I'll also talk about the amount of uncertainty and the level of long-run growth, and whether or not we should actually give up completely on their being a link between growth and the interest rates, okay. And through the talk I'm going to highlight the perspective of an agent who forms their expectations in real time.

So let's look at a bunch of estimates that are out there. These are recent estimates of the natural rate, so three groups of estimates. The first one is model based by econometrician. Second one policy makers, including FOMC members and CBOE. And finally, private sector forecasts of averages, of inflation, and nominal short-term interest rates which give rise to something which should be in the ballpark of equilibrium real rate. Vastly different and what you can see immediately is that model based estimate would suggest that the real rate is negative, equilibrium real rate is negative. And so very negative in a way, while the real time forecasters would say well it's in the range between probably 0 and 1.7 percent. The estimates based on models differ not only in the current level, but also in the time series dynamics, and vastly so. So here are three representative estimates, including the paper that I believe John is going to present, the red line. And the blue line shows you an estimate of the equilibrium real rate from Chicago Fed. And finally, that grey line is a recent estimate by Cordia. You can see vastly different estimates, and it's truly that assumptions and horizons over which those equilibrium rates are computed differ, but within each particular model, which you can see, confidence intervals, there is a confidence interval around the blue line, which you probably cannot see. But what that confidence interval tells you is that in fact those two lines just don't overlap. The red and the blue line don't overlap. So vastly divergent views of where the equilibrium real rate is today, and also how it evolves over time, in particular, how much time variation there is in the rate?

Now let us look at the second set of estimates, which is survey based estimates. These are real time estimates that are formed by professional forecasters. Three lines, two solid lines, are showing you the equilibrium rate that is midterm of the horizon of about five years. And probably the closest to the notion of the equilibrium real rate is the dotted line, which is a really long-term forecast of that rate. It does go down, but it doesn't go down as much as our models would suggest. So my data ends in 2013, but the number that the survey forecasters suggest is about 1.5. At the same time, when you look at the confidence intervals implied by the range of survey forecasts in the long-run, probably you could reject that people think the real rate is below zero.

So very different view of the world between real time forecasters and econometricians. Now I believe it is key to really understand how agents form expectations in real time for the simple reason that those expectations get impounded into interest rates and are a basis for decision making, economic decisions, and then financing costs for households and firms. So I spent some time thinking about how people form expectations, about the short rate, and this chart is showing you terms structures of expectations by professional forecasters. This is the forecast of effective fat funds rate from today, five quarters out. What you can see is clear, systematic pattern where agents expect the fat to tighten more than it turns out to tighten ex post. What does that mean? It means that forecast errors are going to be large ex post. This chart is showing forecast errors that agents make at one year horizon. It can easily reach -400 basis points. And you can clearly see a systematic pattern in those forecast errors.

Now you might not believe survey forecasts. That's fine. If you look at asset prices that can off load on the same object, like a Federal funds futures, they would give you a very similar picture. Now in my work I have argued that post '85 that forecast error has been moving very strongly with errors that people make about unemployment

and output gap, and much less about inflation. So this suggests that what this forecast error really represents is the forecast about the real rate at one year horizon. Now the systematic nature of the error is problematic when you want to do econometrics in full sample. And what this chart is showing you is two types of real rate estimates.

Admittedly, that's a short-term real rate, but the red line is showing you the survey forecaster, what they think real rate is going to be, and the black line is showing you what an econometrician thinks having access to the entire time series of data. The econometrician is not using any revised data, but I assume that they have access to the full sample and estimate parameters from the full sample, which of our models do. And what seems to be the case is that econometricians think that the real rate is going to be actually lower than the real time forecaster. So that dynamic is showing you the wedge in expectations between the econometrician and the real time forecaster, and obviously this wedge is very, very significant. So it can reach up to -200 basis points in recessions.

So it seems that econometricians have a more pessimistic view about the real view than a real time agent. It seems important for us to decide which notion of the real rate we should focus on, whether it's the real time forecast of the agent who makes decisions based on those forecasts, or we should believe more in our econometric estimates.

Now going to my second comment about there being uncertainty and decline in the level of growth, which seems to be at the heart of many models that we use. This chart is showing the term structure of forecasts of real GDP growth from surveys. And the dotted line is one quarter ahead forecast, the red line is one year ahead forecast. Now superimposed is the really long-term forecast of growth. Looking at that chart I see little evidence that we are in a period of really unusually low growth expectations. And again the blue line is showing us 10 year expected growth range,

which seems to go together with the intuition in the paper, but against the secular stagnation view. We are sort of back to normal, above two percent. Now maybe the level of growth expectations hasn't changed, but the uncertainty has increased. This could still push interest rates downward. So I can cast some light on that question again using the physical distributions that agents have in mind when thinking about the distribution of growth expectations. And you see here two plots, one is before crisis and after crisis, and these are the expectations or the probabilities reported by real time forecasters that growth is going to be in a particular range. It is true that on the right hand side you see yes, in the short run growth expectations declined, but after one year we were sort of back to normal, the uncertainty has just increased. What about today? This you can see in the lower graph, in the lower graph on the left hand side you have current distributions as viewed by forecasters, and on the right hand side you see two decades ago. To me, those two distributions of growth as perceived by agents look really, really similar. So I don't see that either uncertainty about long-term growth is vastly different today than it was a couple of decades ago, or the level of growth. The point estimate is vastly different.

And I think the paper makes a very, very important point about the relationship between growth and interest rates for the reason that in most models the positive relationship between growth and interest rates is at the core of the analysis. And this problem is very well known -- well, that the equation that appears in all representative agents models pretty much that we look at. And that intertemporal tradeoff or smoothing of consumptions that the agents make implies higher rate means higher expected consumption growth. Now there is vast literature that says that that relationship is awfully difficult to estimate, and the others confirm that conclusion looking at correlations between growth and real rates. So I think that's a very important take away from that

paper, that building our models on a relationship that is really difficult to detect empirically may not give us reliable conclusions about where the equilibrium real rate in fact is.

Looking at survey forecasts again, very different conclusions about the relationship between growth and real rate, ambiguous results as the others seem to find. People think that productivity growth and the real rate seem to be negatively correlated, but GDP grown and real rate are positively correlated. What I would welcome is more analysis that decomposes the growth of real GDP into components, productivity, and input.

And mu final comment is whether we should entirely give up on the link, on their being a robust link between real rates and -- or interest rates and growth. And I think that we have very robust evidence that such link exists, not maybe in the long-run, which is difficult to detect, in the shorter run. We know from previous studies that term spread, the slope of the term structure, is a very robust predictor of growth. Now conceptually slope moves of the nominal youth curve can move around for three reasons, expected inflation, term premium, or the real rate. And I've done some work that tells me that about 60-70 percent of variation in the slope is due to the real rate variation. So what this very well establishes a relationship between slope and growth captures is an intertemporal trade off in a relatively short run. In other words, what the slope of the term structure seems to capture is a gap, real rate gap, so deviation of the short-term real rate from equilibrium rate. And it seems to be really useful to analyze this insight further because as much as equilibrium rate is important, it is also important to understand where monetary policy stands today in terms of real rate compared to the equilibrium rate.

So let me conclude. I broadly agree with the conclusions of this paper.

Looking at the data that I have analyzed, I do think that it is really important for us to

embrace the notion that real time expectations matter because they are the basis for decision making, and those seem to be based -- the discrepancies between models and those real time expectations are just too large to ignore. There are some strong model assumptions that underlie much of our analysis and I do think that thinking more carefully about how those assumptions translate in estimates is really important.

So great paper, very important topic. Thank you. (Applause)

MS. SHEINER: Thank you for a great paper and a great discussion. We just have a few minutes here and then we'll have more time for discussion later. But first I want to give the authors, either the ones in the audience or you a chance to respond to Anna's comments.

MR. WEST: I thought they were great comments. I learned from them, I enjoyed them.

MS. SHEINER: Anybody?

MR. HAMILTON: Jim Hamilton. Thanks. I agree with Ken, those were fantastic comments and great evidence that I think compliments quite a bit what we're saying.

One thing I'd emphasize, and I think you were trying to say this too, there is a difference between a one year ahead forecast and a seven year ahead prognosis. I mean I think we all agree that what happens to GDP in 2016 is going to be related to what the Fed funds rate that the Fed sets. But the question is, is there this long-run correlation. That's the evidence that we look for and found a lot less confirmation than we were expecting to.

MS. SHEINER: Okay, I have some questions. So let me ask you a question, so you give us this narrative which is really interesting, but do you not have sort of a one story for the reason for the secular decline in the real rate that we've seen since

story?

the '80s, or is it really just a bunch of series of different things that have happened along the way?

MR. WEST: A bunch of series of different things. We can point to perhaps productivity, demographics, global savings glut, changes in discount factors, many things.

MS. SHEINER: Just many things?

MR. WEST: Yes.

MS. SHEINER: So they're not like oh, here is what really is the big

MR. WEST: Correct.

MS. SHEINER: Do you think that your paper shows that there is no important relationship between the growth rate of the economy and the real rate or just that it's really hard to prove?

MR. WEST: My view, very hard to prove, very hard to prove. It's got to be a factor, it's got to be a serious factor, however so many other things are also serious factors that the link is hard to identify and it would be foolish to rely exclusively or predominantly on that link.

MS. SHEINER: So you give an estimate of the real rate that is sort of relatively low relative to history. If you don't know sort of what causes it why is it you've sort of gone lower in the near term?

MR. WEST: First, let's review that we have this range from zero to two, and two includes the traditional value. And I would say that the two had to do with maybe what's happened in recent history we'll return to. The lower end in terms of the forecasting ended up with had to do with just looking at rates itself, which is rates are low globally and if rates are low globally in an integrated capital market, we're going to expect

U.S. rates to stay low.

The story as to why rates are low globally we do not supply.

MS. SHEINER: So what would you say actually to someone from CBO who actually got into trouble when they sort of changed their productivity growth rate and didn't change and didn't change their interest rate assumption? When you're trying to do these long-term forecasts would you say you should still sort of go back to theory and assume there's a relationship, or should they let those sort of become disassociated?

MR. WEST: Well, I would quote Chairman Mao and say let (laughter) 100 flowers bloom, let 100 schools of thought contend, and you should not rely on any one approach to think about any important economic question. I think actually we illustrated that in the paper with two wildly different approaches. So if part of the CBO's forecast ties interest rates to productivity, all to the good. If part of it does not, so much the better.

MS. SHEINER: So sort of assume there's something but maybe discount it a lot because, you know, put a little bit of a nod to theory but not 100 percent?

MR. KING: Right. Yes.

MS. SHEINER: Yeah, Jan?

MR. HATZIUS: Jan Hatzius, Goldman Sachs. I mean I would answer your question also saying that you shouldn't be too confident in the link. And if you think about it in terms of core efficiencies, you know, if you have a one percentage point slow down in potential growth for example, I would be reluctant to put all of that one for one into a low equilibrium rate. You know, maybe half I could sort of see myself doing that, but I wouldn't give up on it, but just basically pass it through only partially into our (inaudible).

MS. SHEINER: And so let me ask another question which Anna

mentioned, which is so when we're looking forward a lot of the slowdown that we expect in real GDP growth is coming from demographics, from slower labor force growth and not -- some from also slower productivity growth, but not all of it. Different models will have different implications about whether or not that slowdown in labor force growth is going to feed through to the equilibrium real rate. Have you thought about trying to separate out the two? And do you have any intuition about whether or not you would even be able to see that in the data or?

MR. KING: Yes. I'd emphasize the point about it's a world capital market. And I think too much of this discussion looks at U.S. demographics or whatever, but the U.S. rate cannot permanently deviate from the world rate.

MS. SHEINER: Well, but the demographic change is pretty much worldwide I think. So if you look at many, many countries are having a slowdown in labor force growth. So I think you would still -- and in fact faster than U.S. on average -- so I think that actually might make it even a bigger effect that what you would see if you restrict it to the United States.

Is there anybody else?

Okay, we have a few minutes for a few questions from the audience. There's one back there.

MR. TANZI: Thank you. Vito Tanzi, formerly IMF. In the early '80s there was a lot of discussion about the relationship between interest rate and taxes. Taxes came down dramatically since the '80s. In the '80s the normal real rate was assume to be three percent. In your models many assume that it is two percent. But there I saw no reference to taxes in your discussion. Should we ignore taxes? By the way tax came down dramatically since the '80s.

MR. WEST: Wow. So I had the slide with the narrative discussion. It

listed, what, 12 things. Should we have included taxes on that? We have to say we told a coherent story without reference to taxes, but perhaps there's another bullet point to be added. (Laughter)

MR. WEST: We're talking about long-run remember, we're not talking about poignant times. So your article was talking about a long-run effect on the real rate.

MR. TANZI: Yes, but that (inaudible).

MR. WEST: Ethan there can tell him.

MR. HARRIS: Ethan Harris. I feel compelled to say something since I'm an author here. I just wanted to reinforce the point about why we were skeptical about the idea that the real rate has dropped as much as people think. We have to remember that this story is not new. We had exactly the same story in the last business cycle. You had the so called new normal, and it is now being recycled again.

The other thing I would say, my personal view is that the main reason why rates have been so low in this recovery is because we've had massive post crisis deleveraging, we've had a global backdrop that's equally troubled, and then on top of that we've had a combination of aggressive fiscal austerity and not to mention brinkmanship, just to make it a little bit tougher. So I've always had a lot of sympathy for the Fed and their desperate attempts to get the economy to grow, but I think the headwinds they face have been massive. And so to me that's the main argument for why there's kind of an artificial cyclical distortion to the neutral rate, and it's not secular stagnation.

MS. SHEINER: Let me ask you a question about the brinkmanship (inaudible). So you could think of it as affecting both the riskiness of the asset and also I guess investment demand? Is that -- you think it's a matter of -- why is the brinkmanship bringing rates down?

MR. HARRIS: Well, I think brinkmanship is basically discouraging

investment and long-term commitments, so part of the reason for the subnormal capital spending recovery and weak growth and durable goods demand in general. And you could see it in real time. You know, you could see as we approach the fiscal cliff and some of these other episodes there did seem to be this kind of holding back in the corporate sector.

MS. SHEINER: Okay. There's a question over here. And could you please stand when you ask questions. Identify yourself and stand. Right over there, this gentleman. You can just stand.

MR. DOYLE: Hello, I'm Peter Doyle. In looking at your long-term series, going back to the 1850s and so on, I believe you used to -- in your modeling looking forward there's no mention of capital controls either here or abroad and presumably that greatly affects both the determines that real rate here and the connection with the world rates. And I also didn't see it on your list of -- another items missing from your list of bullets, capital controls.

MR. WEST: Fair enough, fair enough. I will say that we're able to tell a coherent story, certainly statistically, abstracting from capital controls. So that bivariate model with global rates and the U.S. rate, you're right, did not have any special dummies for period of capital controls. Nonetheless, the data didn't seem to complain about that. Various statistical tests suggest that it fit the data well. But I take your point, I understand your point.

MR. BROWN: Stuart Brown. You showed a negative real rate and suggested there would be a tendency toward the mean of a higher number, but I'm wondering if you studied periods of deflation. And what happened in past periods of negative real rate to actually turn that angle around?

MR. WEST: So we had previous periods of negative real rates and that

graph went by pretty quickly, most notably in the Depression, and what turned that around was of course World War II. We episodically had negative real rates after World War I and in the 1970s. So I would say in all of those cases what turned it around was we ultimately grew. And I think I have confidence we will ultimately grow. Part of the story why I don't think negative real rates are here to stay. So I don't think any of us endorse the secular stagnation view that, you know, growth is gone.

MS. SHEINER: Anna, do you have any comments on any of the questions? I'll give you a chance.

MS. CIESLAK: So talking about deflationary periods in the U.S., it seems important to distinguish between the properties of inflation versus deflation.

Before World War II and currently the short episodes of deflation were extremely transitory, while periods of inflation were very, very persistent. So we don't really have data on persistent instances of deflation. And in those transitory episodes of deflation, real rate was positive, as you guys showed.

MS. SHEINER: Right. Well, do more questions later when we get back to the panel, but I think I'd just like to thank our authors and our discussant for a great panel. And thank you very much and we're going to get our mics off and then introduce John Williams. (Applause)

MR. WILLIAMS: Well, it's great to be here. And I thank Anil and David for inviting Thomas and I to give this new paper on Natural Rate of Interest. It's actually great that Ken gave such a great presentation, and we had such a good discussion already, because I think we covered a lot of the basic topics and data and issues, and so I can do what I prefer to do in the presentation, and talk about my own work.

So, importantly, in very tiny print it says, "The views presented here are those of the authors, and don't necessarily -- not necessarily those of anyone else in the

Federal Reserve System." So there are 20,000 people I am not suggesting support this. So, let me give a summary, and it does relate closely to the paper, the earlier paper in Ken's great presentation.

First, I'm going -- when we started this project around 15 years ago, we naturally, having studied Time Series Econometrics and having learned from people like Ken and Jim, all of that, we first started with thinking about this, in terms of trans-cycle decompositions in univariate sense. Looking at, you know, filters and time series methods, or the things we quickly figured out, which I think is mentioned in their paper, too, the various problems looking at purely univariate measures of real interest rates to try to figure out what's going on in the long run.

We have the same concept that Ken talked about, what's the real interest rate is going to be in five or seven years, and the problem here is that there are these persistent deviations from stable inflation and potential output during these periods. And so you see these periods of very low interest rates, and sometimes high interest rates, or other times which really reflect cyclical or maybe a medium-term inflationary dynamics, and not really longer term view on real interest rate.

So what we did is we thought that really need a system of equations to think about this. You need to think about what's happening with output, what's happening inflation, what's happening with interest rates, to think about what's happening with trend, potential output growth. You have to really think about this as a system of equations, and that way you can control for the things that Ken talked about.

The fact that inflation is moving up and down, you are deep in the soup in terms of being in recession and things, and really try to filter out, whether or not the -- separate out cyclical developments in real interest rates from longer-term developments.

You know, the key finding we've had, and by the way, we update our

estimates every quarter and post them on the San Francisco Fed's website, and provide the programs as well, is that since, basically, 2009, from starting in 2008, 2009, our estimates of the natural rate of interest fell from just roughly 2 percent, consensus view, down to essentially zero. And importantly our estimates show no signs of recovering since then, they are currently around zero, as well, even in 2015 Q2.

And this is, as I'm going to talk about, robust alternative model specifications, and I will give credit to the authors. This morning we were at an early version of -- an earlier presentation of this paper, and that I actually I think stirred both Thomas and I to think hard about a lot of the questions that they raise in their paper, and how do we think about those in the context of our own approach.

We are going to talk very briefly about monetary policy strategies that will need to be designed to cope with -- if they are persistently low natural rate of interest, and high degree of natural rate of uncertainty, which is something we also highlight as was discussed earlier, how do you think about that in terms of designing monetary policy strategies that do well even in an environment with very low natural rates, and uncertain natural rates.

Now I think it's important to start with the definitions in terms, so we'll go back to Wicksell in the end of the 19th Century and. "There's a certain rate of interest on loans which is neutral in respect to commodity prices, and tends neither to raise nor to lower them." So really it captured in here, is already multivariate, or bivariate definition of the natural rate. And I'm going to come back to the John H. Williams quote, which I just think economists should write like poets, and that's just a great quote, how often do you hear the term faith in describing a model. But here we have the --

MR. WESSEL: Probably (inaudible).

MR. WILLIAMS: I know. Thank you, David. That was like one of those

Mets fast balls, right. Here, you can see that the natural rate is already defined in terms of inflation, so in terms of thinking about it, you have to have a concept of natural rate that reflects inflation and, again, already from the beginning that univariate approach isn't going to work for that.

Our basic idea is simple, I think it goes to the undergraduate ECON 101, or maybe intermediate macro, and our view of the natural rate, which I think is a common to a lot of analysis, even if you use the DSGE model or a fancy model. It's basically there's a notion of potential output; the X-Axis is real GDP here. There is a veridical line, I think it's exactly the same line that's on this background, and then there is a real interest rate, it's a Y axis, and there's an intersection between basically potential output or supply, and the downward-sloping IS curve relating demand, real interest rates, and that intersection between output and potential output, gives you the natural rate of interest, or the equilibrium real interest rate.

In our paper we are really focused on this, again, longer-term or medium-term notion, not the naturally rate of interest, month-by-month or quarter, but again, this seven years out I think it's very similar. So, you can think about shifts and either any of the curves, potentially I think I can hit a dozen. I think we have the same list, we actually did have fiscal policy on our list, because of the work Thomas Laubach has made, showing that fiscal policy can have effects on long-term interest rates, and so you can think of more expansionary fiscal policy is shifting out the IS curve in the long run, giving you a higher natural rate. Of course there's a lot of things that could affect that, as Ken talked about. You know, I agree, there are a lot.

The one thing about univariate measures, I'll just very briefly mention, given the time, is so here we show a bunch of band-pass filters, Hodrick-Prescott filters, Stock, Watson, Time Series models, take some averages over five years, and the point

was already, I think, made by Ken in his paper, we talked about it too. First of all you do see, over decades, a variation in real interest rates, and if you look over the longer history they can last for decades.

You see periods of very high real interest rates, and obviously today very, very low real interest rates, but one of the problems you see here is that during the period where inflation was rising, during the '60s and early-'70s, real interest rates were really low, and the univariate methods were saying, oh, well, the natural rate must be low.

Well, in fact what was happening it was part, monetary policy was too easy, it was inflationary, those low real interest rates weren't equilibrium, they were off equilibrium. Similarly, the early '80s, the great disinflation under Paul Volcker, the Fed purposely raised interest rates above the natural rate to bring inflation down.

And the last point I'll make in this, I think an important issue, is any kind of Time Series method that's on the univariate basis is going to look at seven years of negative real interest rates is going to assign a lot of that to the trend. I mean, it's just mechanically going to tell you that the trend of the real interest rate is very, very low today, and in fact that's what all those estimates show, is roughly minus 1.5 percent, which is what real interest rates have averaged over seven years.

So this is kind of the arguments that tell you, you can't just -- you can't stop with the univariate estimate. I'm not going to read the John H. Williams quote, but it is exactly how we approach this. This is the Laubach-Williams approach, it's basically to say, let's come up with a model, where, if inflation is rising, and we are going to talk about inflation not prices, but if inflation is rising, that must be the case that the real rate is below the natural rate, and if inflation is falling the opposite is true.

So you are inferring from movements in inflation and output, a view on potential output, from the upper gap, trend output growth in on the natural rate of interest.

So all inference indirect from the movements of inflation and output onto what the underlying natural rate must be.

Now, here are our main results. At first let me show you the model equation just for the natural rate of interest, or R-star. So the right you see that R-star equals C, which is a constant which we estimate, times our estimate of trend growth, that's in this case real GDP growth, plus Z.

So Z is the special sauce of Laubach and Williams. So this is the thing we should be focused on. This is why I tend to disagree with the emphasis on the earlier paper, because they really do highlight the C times G-star part, which of course we talked about in the paper it is a key element of our model, and to talk more about that, but actually Z is doing the heavy lifting.

This is to be the variable, and what is Z? Z, we are going to assume is an unobserved random lock, it persistently in Econ Geek, it's an I-1 variable, and it's inferred, again from the data. Z captures, I'm looking at the 12, maybe 13, maybe 14 bullet points that can Ken and the other participants talked about, that are not G-star. So it is all the things that we don't observe directly or don't measure very well, is captured by this -- what we treat as an exogenous variables Z.

In the model we estimate the output gap the trend growth rate, and again Z is this highly persistent, we are thinking 5 to 10 years window, of other influence in R-star, but we are not going to actually put data in there, we are just going to let that be an unobserved variable, that we are going to try to estimate.

Here are our estimates, going back to 1980. The blue line is called current estimates that means that we estimate the data through second quarter of this year. This is what we get for the retrospective view of what the natural rate is, very consistent with the message that Ken gave that -- and I'll go back a little further.

I think typical estimates and natural rate, this is, one of the speaker said, it's a typical estimate and was about 3 percent back in the '80s, about 2.5 percent in the '90s, 2 percent right on the cusp of the Great Recession, you can see the blue line coming down to about 2, and then with the grey bars are the recession dates, NBER recession dates, and then you see a plummet from December of 2007 into 2009, down to essentially zero, and it's been zero or slightly negative since.

The red dash line is actually, since we wrote this paper in 2001, we published it in 2003, we've just basically, we have been doing real-time estimates throughout much of this -- all of the period I'm showing, so these are the estimates you got in 2006, '07, '08, '09 as the data rolled in, we ran the model, we came up with the estimates. What's interesting here is that red dash line and the blue during the period of the Great Recession in the last seven years have been basically the same, just some minor deviations, the data gets revised, the model gets re-estimated, but really, there is not some big disconnect between what we are seeing today, and if you had asked me the question in 2010, what's the natural rate of interest in the Laubach-Williams model? I would have said, zero.

And that's what I'm saying today, at least in this model. So there's a consistent message here, and you notice there's really no signs outside of the quarter-to-quarter movements of this thing moving off zero. So going back to the slide that Ken presented, he said he presented that, I think, in February, and he hasn't changed the slide, I can do the same here, our estimates haven't changed either.

Let me talk a little bit about other estimates. We talked I think, Anna talked about this, I think it's really useful. I'm going put a little word of caution, so what I'm going -- on this at the end. So, the first line is the Blue Chip Survey, what's nice about that, I think Anna showed it, or Ken may have showed it, it's to ask; what do think real

interest rates are going to be 5 to 10 years out? So the question really does conform to our view.

So you see the estimate in 1990 about 3 percent, fell to about 2.5, 2.4, and today it's roughly 1.2 percent, so it's a decline during the since the beginning of the Great Recession of 1.2 percentage points. If you look at TIPS yields, they went from 2.5 down to about 1 or a little less, again a decline of 1.5, similar to what the earlier speakers had. So, when you talk about Laubach-Williams estimates, they are a little over 3 percent in 1990, about 2 percent 2007, and again a consistent message, and then fell to essentially zero today. And that's a decline of 2.3 percentage points since 2007.

So, as was pointed out, we have the biggest -- lowest estimates and the biggest declines compared to some of these other estimates. So, what's happening in the Laubach-Williams model? Why is it saying that the natural rate of interest is zero? What's in the data? Because it's not a theoretical model, it's basically a reduced form model.

So what it's doing; is it's looking at the pace of inflation, and inflation fell during the recession, but it's been relatively stable around core inflation. You know, around 1.25, 1.5 percent. So out of that it infers that output gap was very negative, and then is corrected closer towards zero as the economy recovered.

It also is seen that the output growth consistent with this inflation has slowed quite a bit, so the estimate is a potential output in the model, but potential output growth rate have fallen quite a bit since 2007. And so with the signs because of this relationship between potential output growth and R-star, it assigns some of that declining -- in growth, trend growth to R-star.

And then the final thing it does, and I'm going to just use a very simple example, is that it says, well, over the last five years GDP growth has been about 2.1

percent, potential growth in our model is about 2.1 percent, plus or minus. So, growth has been basically on trend, the output gap now in our model has been closed for a little bit, it's actually positive right, I'll come back to that. But basically with growth at trend, with no signs of upward or downward pressure -- major signs of upward or downward pressure on inflation, it's just saying, well, five years of this, this is probably, a lot of this is trend, a lot of this is permanent. It's not all just cyclical phenomena.

Now it's just a -- it's a trend cycle we composition in a multivariate sense, so what you see here in our last column, is that the decline since 2007, about 1 percentage point, of that 2.3 percentage point decline is because of the trend growth part, but a slightly bigger part of it, is actually because all of these other factors that Ken talked about, and we talk about in our paper too.

Other things that e don't directly observe, but clearly are indicating that there isn't as much monetary stimulus in the system as you would think. Because if R-star were 2, then the real funds rate minus 1.5, and you have a 3.5 percentage point outbound, real rate gap, our model would expect output growth to be much faster. It's not happening to the models inferring that there is some significant headwinds, which are partially permanent that holding back growth.

Now we talk about robustness, and this is really -- I give credit to the authors of the paper we saw this morning, for stirring us, I think, to think harder again about alternatives. And so one alternative we looked at, and this gets to Louise's question, so we actually have the answer, theory doesn't tell whether you should be looking at GDP growth, or per capita GDP growth, or demographics or productivity.

So took one cut at that. We just said, let's look at GDP per capita which is taking the demographics at least the population sends out, and we re-estimated our model, and that's shown with the red line. The blue line, again, is our standard estimates

of the natural rates of interest. The blue and red lines, you know, are within a few tenths of each other. Basically, our model is flexible enough with this, you know, this magical Z variable to basically differences in the data, whether you are doing it one way or the other don't really affect our natural rates, you are getting the same story.

Basically it's saying -- it's getting a slightly different breakdown between the growth component and the Z component, you get the same answer in the natural rate of interest. We also looked, and again, kind of under duress because of this criticism about the relationship between R-star and G-star, and also some criticism of our estimates of the output gap which, a lot of uncertainty about that. We took a different estimate of the output gap from work by our colleagues at the Board, Charles Fleischman and John Roberts, as a really sophisticated model, and I said that because John is in the audience.

It's a really sophisticated model of -- I tried to at the output gap, it's much more, I think, detailed and involved than ours. They get in different estimates of the output gap. I think it maybe more -- closer to CBO and other estimates and output gaps, so it's viewed by some people as more reasonable. So we plugged that in. We also break the relationship between growth and R-star.

We just say, R-star is some random lock, we are going to estimate. We actually get -- their output gaps are more negative than ours, so we actually get more volatile R-stars, just because that's how the estimation works. But the point is that they also fall very negative, or fall below zero, and follow the same pattern of coming down since 2007. So I think these particular estimates change as you change, different specifications, but the basic patterns hold up pretty strongly.

So, in my last few minutes I want to talk about the two issues. One is, is this permanent or not? Now, one of the things that Ken and his coauthors have

highlighted in their paper is, there seems to be a correction, or mean reversion in real interest rates, and we don't want to say it's permanent.

And I hear words like "reasonable" I don't remember reasonable being in Jim Hamilton's book, or Ken West's papers, plausible is a word I believe John used, so I'm not sure what is reasonable or plausible. You know, I don't have a strong prior on that. But I'll give you some other results from other models that did. They imposed a strong prior; that this is -- real rates mean reversions were being held back by temporary headwinds.

This is a work by Vasco Curdia, my colleague at San Francisco Fed using the DSGE model, and recent economic letter, which I think is great analysis. He does the calculation of the short-term natural rates, not the long-term, so it moves a lot more over time. Let's not compare numbers here, because the short one -- your short-term natural rate moves more. But what he shows is it plummets in the recession, so watch the blue line as the current estimates.

It goes from being about 2 percent which is long-run estimates, plummets to negative values once the Great Recession happens, but then all these dash lines show what his model said, the natural rate of interest would do forecasting from his model, because the model imposes a structure that it's mean-reverting, estimated mean-reverting process of the shocks in the dynamics.

And what you see is every vintage, 2008, 2010, '12, and today, everyone of them have said, well the past rangers would have said, the natural rate will be back to zero, but his current estimate show that that never happened. Every time his model said it would go back 2 -- I'm sorry -- what happen is data kept coming in confirming that the natural rate is actually very low, and except for a little bit of a movement up, it's natural the estimate is still below negative 2.

Again, as Maury's forecasting it moves back to 2, that's by assumption. So, these DSGE models, and other models that impose the structure, they are plausible, I think there, it's good to have a -- I don't normally quote Chairman Mao, but I think he's right on this, "Let a thousand models bloom," but so far these models have been, I think giving us a false signal.

We also did an alternative version of LW, where actually assume that Z is an AR(1) process, so we basically said, okay, let's stop assuming these are permanent, let's let them be transitory, and re-estimate the model. So now we have short-term R-star -- a short-run R-star, a long-run R-star, the results we get is, the long run R-start has come down to 0.8 percentage point so it's not zero. It does assign some of this to short-term temporary factors.

You see the short-run R-star falling to very negative, like in DSGE models, and it's moved back towards zero. So, the short-run R-star in this model, but doesn't impose permanence; is around zero, similar to our standard model. The long-run is closer at this point.

Okay. So I've got 30 seconds to talk about what people -- what does this all mean? And so I think there are two issues that we really should be focused on, and I don't have the answers, but I think the issues are really important. One is R-star mismeasurement. If you look in the paper, basically you think about this as a Taylor Rule, R-star is your intercept in your Taylor Rule, and if you have the wrong value of R-star persistently over time, that's going to show up through the math of these models and the Taylor Rule as by persistent or permanently missing of your inflation target.

So, what happens is the mistake you are making, understand how the Taylor Rule translates into mistakes in terms of your outcomes. So there's been a lot of research, Athanasios, Orphanides, and I, and others, have studied this, and basically

said, with lot of uncertainty about the natural rate of interest, you really want to move to policy strategies or more robust to that. We talk about difference rules, or other strategies with inertia that avoid that, and Ken mentioned that briefly.

I think the second issue is even more important, and that is, you may not be convinced that R-star zero, it could be 0.8, it could be 1.5, but if it is below, significantly below 2 percent, we do need to think seriously about; what does that mean for longer-term monetary policy strategy:

So, here is a little I-star arithmetic. I-star is the neutral nominal interest rate, it's equal to the R-star plus inflation target, and if you have a lower R-star it means you are going to start every recession with a lower nominal interest rate, you get less room to cut rates.

Typically we cut rates 400, 500 basis points in the recession. If you've got an R-star of 1, that means you are going to start with only 300 basis points of room to cut, and you are going to hit the zero lower bound a lot more, you are going to be stuck there more, and the macroeconomic consequences are greater than they were in the past, when R-star was 2 or 3. There are a lot of issues that we should, I think, you can address this, one is with a large central bank balance sheet, that would point to our analysis of a large central bank balance sheet might boost R-star by lowering term premium in the markets.

I can basically shift out the IS curve. You can think about higher inflation target, as Olivier Blanchard and others have talked about. Again, this is just the arithmetic, if you need more buffer, that's one way to get it. I think those issues about how easy it is to shift an inflation objective, because the issue of going to using negative short-term interest rate, obviously QE, forward gains, all the tools that we have shown that we can use, and other central banks have shown that they can use around this,

around the zero lower bound, or the effective lower bound.

But quite honestly, here is where I think the real answer is. That we really need to think seriously about other policies outside of monetary policy to get trend growth aggregate demand higher, so that R-star is higher. So this is one of those times, where monetary policy really depends, critically, on fiscal and other policies, not just in the short run, but in the long run. Thank you. (Applause)

MR. OBSTFELD: Okay. Good morning. It's a pleasure to be here and discuss this paper, it's a very nice paper and I really like the structural approach the authors take, and I'll talk a little bit more about it, beyond what John has said. It's also a pleasure to be in a session with the first paper, because when you put them together, you get a great perspective on some of the debates. And I won't continually refer back to the first paper, although obviously, if you've been paying attention and not on your cell phone, you will see where some of the connections are. And, I mean, I'm as bad an offender as any of you.

Okay. Two key questions we are talking about this morning, obviously are: How low, and how long? The basic data we are familiar with in this chart, I'm not only showing a short rate, which is the three-month TIBOR rate, we've been talking more even a shorter rate, the Federal Funds rate, but also a 10-year real rate, and the trends are pretty clear in the data. These rates use a survey of professionals, forecasters, consensus expectations to get at inflation expectations.

But no matter now you dice it or slice it, you tend to get the same number, the short-term real rates are pretty negative right now. Why does this matter? Again, the authors this morning have talked about this, most recently John a couple of seconds ago, you know, the perils of the zero lower bound what does that -- how does that constrain monetary policy?

There are also implications for fiscal policy though, it may be that with lower interest rates, there's more fiscal policy space. The fiscal policy is constrained by political factors thought that's not going to help us very much. But in this ZLB and fiscal-policy-constrained environment, there may be higher-trend deflation, and this can raise the perils of debt deflation, which can lead to a vicious cycle in which higher debts push demand lower, lead to even more deflation, and so on.

And it's probably true that one of the factors that has made the recovery from the financial crisis and the debt overhang slower has been very, very low inflation, verging on deflation in some countries and, you know, Ken Rogoff has certainly pushed the idea of having a higher inflation target for that reason.

You know, finally, if real interest rates and growth are linked in the way the theory says, and we've had a lot of discussion about that this morning, but let's just say that there's some connection for the sake of argument, then low real interest rates could foretell lower future growth. Just a partial list of what people have been saying, I won't through this, except to plug some of the work that my new employer, the IMF, and my last employer, the Council of Economic Advisors.

But the consensus is certainly that real interest rates are lower. How long, how permanent, this is a matter of more debate. The most recent thing that came across my desk was the last item, the Geneva Report from CEPR, which is more n the optimistic side about all this, but says we cannot be certain about either the magnitude or the pace of a recovery in the neutral real rate, and I think nobody in this room would disagree with that assessment.

What does this paper say? Well, first of all this is a paper about the natural rate, and as Ken indicated, there are a zillion definitions out there of what we are talking about, but this one, very much in the spirit of the first paper, is about a very long-

run natural rate. Once all, sort of transitory shocks have disappeared. Some people like to call this the equilibrium rate, you know, let's be clear on the concept.

No evidence that this has moved back, even with the economy close to fully recovered from the Great Recession, and John showed that very nice chart. You know, just a note about that chart, that if you look at it, there's actually what seems to be a permanent fall after the early 2000s recession. Nothing near as steep or as dramatic as what we saw after the GFC, but it's notable that there has been these seemingly permanent falls in their data. They also look at financial crises, and this was not talked about very much, but they find that after the typical financial crisis, rates actually recover after about five years. Not so this time. Episodes of the zero lower bound, they say, are likely to be more frequent and longer.

So, let me talk about their methodology, as John indicated, the big advantage of this methodology over univariate methods, is it allows you to really put I more information about what's going on. For example, think about the Volcker disinflation, we saw a sharp rise in real interest rates, but we also saw a fall in inflation. This might tell you that the market interest rate is an overestimate of the natural rate because, you know, inflation is falling at the same time. So, their estimator builds this kind of information in, and I think this is a major advantage of this approach.

I won't say too much about this because we only have a few minutes left, but they estimate an equation linking the natural real rate to the natural rate of growth which is unobserved, but they estimate that and they find that their coefficient which corresponds to inverse of what Anna called Sigma, the intertemporal elasticity of substitution is about 1.3, telling us that Sigma is about 0.77, very much in line with the types of estimates economists believe.

You know, and their reading growth is rather important, but it's less than

half of what's going on, and they have this portamento variable Z which covers everything else. I just wanted to show you something that Jim Stahl calculated and that he generously shared with me, that even if you are using the univariate approach, if you look at really long-term fluctuations there is a case that growth and the real interest rates are correlated. Now, this is the long-term rate, and these calculations are for a period that is greater than or equal to 12 years.

But there does seem to be this long-term correlation, and notably it increases dramatically when you add in the global financial crisis and the aftermath. So this is something we should think about.

Okay, very few minutes left, so let me talk about some conceptual issues. One that's been mentioned and that is featured in the first paper, is the open economy framework. The global capital market has become more highly integrated over time, and in principle, if that's the case, the real interest rate should depend on global growth, not just the domestic U.S. rate of growth.

You could put these factors into the IS and Philips curves that are the basis of this model. And you can think that an extension might even allow you to get to at some allusive concepts that we worry about a lot of the Fund, the long-run current account balance, the long-run real exchange rate. That would be pretty interesting. But just illustrating the coherence here, this shows the inter-quartile range of short-term real interest rates for a large sample of counties, and you can see that they trend very closely together, the weighted average has been negative, has come up a little, but there's definitely something about the global environment that I think we ignore at our peril when we try to analyze U.S. real rates.

Now, the U.S. has also become a smaller fraction of the global economy, dramatically so over the past 15 years or so. So this is something I think we should take

into account. Sorry, going the wrong way.

A second issue I want to raise is the anchor for expectations. I don't want to go through these equations, but I will just mention that when we think about the relationship between inflation and the gap between the natural and the equilibrium real rate, there's also a term that involves long-run expectations, and looking back at the original LW Paper from 2003, it wasn't totally obvious to me how this gets in the picture.

Presumably there's a Taylor Rule in the background that's tying this down. But when we get to this zero lower bound, you are not operating with the Taylor Rule, and the link between policy and expectation becomes much more loose, in fact inflation expectations can easily become unanchored in the downward direction. If we look at Japan these days, there's a good case to be made that that's the case.

Throughout the world, there's a lot of lowflation, if not deflation. The green line here is the number of countries in the world with inflation below 2 percent, and red is below zero, and you see these are creeping up. Maybe some of this is commodities, and particularly the price of oil. My gut suspicion is that something more sinister is going on, and somehow, you know, the model doesn't really quite come to grips with what is going on here. So this is something I'd like to know more about.

A few other issues and questions, because I'm getting the eye here, and I'm really out of time; standard errors. If you look at the 2003 paper, there's a lot of variability in these standard errors and I would have liked to see more on ranges. Now, LBJ has reported -- who have said to his economic advisor once, "Rangers are for cattle, give me a number." But you know, as economists I think we want to know what the range of uncertainty is.

Another big question which, you know, is sort of at the heart and what we've been talking about this morning, and unfortunately neither paper really brings forth

hard evidence on this. It's just the question of, why have real rates fallen? There are a number of explanations, they are not disjoint, and a lot of them are global in scope.

Low growth expectations, the IMF is forecasting, that doesn't mean it will be true, but it's forecasting lower potential growth across the world. Okay? It's not just a U.S. thing. U.S. potential growth may or may not have fallen a lot, the Fed has certainly marked it down some, but across the world it is lower.

We had a lot of commodity exporters riding on China's growth, with rapid growth they have been more or less collapsing. And China itself is growing more slowly. Related, low aggregate demand; again, a global phenomenon; without saying whether this lower aggregate demand story is about Global Saving Glut, *a la* Bernanke; and temporary or secular stagnation, *a la* Summers, and more permanent, no question aggregate demand is low.

And then there's demographics. This looks kind of permanent to me. It's true, China just relaxed its One-Child Policy, but we are in a global demographic transition, and there are a number of theoretical models suggesting that maybe this is a factor. And this list doesn't exhaust everything. There are safe assets and the shortage of safe assets. The Euro crisis wiped out a whole class of safe assets.

One thing I don't think people have thought a lot about or enough about, it's just the nature of uncertainty. We had a global financial crisis when we thought we were in a great moderation, now the world looks much riskier. There is climate change, there are super bugs, there is ISIS. The world looks much riskier. Shouldn't this impact interest rate and precautionary savings? I think the answer is yes, but our models don't really come to grips with this. So, a lot is in that Z variable, and we need to unpack it. (Applause)

MR. WESSEL: Thank you. I think I'm going to change the -- so why

don't John and Maury, why don't you come up, and Thomas and Jan, why don't you come up as well, and we'll just integrate, to be a little more efficient.

Well, I want to thank all of you for provocative presentations. I'll remind you of something that my colleague, Louise Sheiner, has pointed out to me a number of times that, the list of things that economists done really understand seems to be growing faster than the number of things that economists do understand; which is a little troubling. That was a joke, John, don't look so serious.

MR. WILLIAMS: I thought it was a full employment act for economists -MR. WESSEL: True, not to mention think tanks. Maybe I could just start
off with Thomas and John, do you respond at all to what Maury had to say.

MR. WILLIAMS: Sure. Just very briefly. First of all, thank you, Maury those are great comments. I agree with all of them. I think you highlighted some key issues; I actually pulled out my briefcase. A really nice, recent IMF Working Paper that is trying to, you know, look at it from a global perspective. Trying to unpack, I think is the word you used, the Z. We started this project saying that we don't really know what's going there, so we want to be as agnostic and flexible.

There is a lot of work at the IMF, the Bank of England, and at the Federal Reserve as well, and other places, who are trying to now dig into this, and get better answers, and so I think that is important work. I want to make one comment about Kiley Paper, which highlights, I think, really nicely how to bring in some other domestic factors to try to explain the low natural rate including risk spreads and things like that. That makes complete sense to me.

I think the hard thing is, and we always run into is; are those permanent, are those transitory? So what Mike does, and it's a reasonable approach, is to say, well I'm going to -- you know, as always I'm going to make assumptions, I'm going to assume

that these are transitory, and these permanent and estimate them that way. So he gets estimates, I believe, about 1.25 for the long-run natural rate by using a framework like ours but adding these other variables.

But the question I have, and you see this in the IMF work too, is while these are supposedly transitory variables are still quite depressed or pushing the natural rate down; so, in a way you are answering the question by assuming that these things will go away, and we are still not convinced by that.

MR. WESSEL: Thomas, do you want to add anything?

MR. LAUBACH: So, I first of all, I would like to add my thanks. And I agree with what John is saying, is I think we are not -- you know, we are not taking here a very dogmatic view, but it's certainly that the surprise reason here is that it's been all in one direction. Maybe that is much more persistent form.

MR. WESSEL: But it seems to me that Laubach and Williams keep alive the possibility that we are in a period of secular stagnation, of very low growth, and we should look at the symptom, low natural rate as a symptom of that. And Jan, the paper that you did, kind of questions that and say, no, I wouldn't worry about that so much, as well it could be temporary headwinds.

MR. HATZIUS: Yes. With a lot of uncertainty, but I would say that, yes, my expectation would still be that we'll move back into positive territory. If I had to put down a number, personally, and I think the authors of the paper, all have sort of slightly different views on that, I would put it somewhere in the 1 to 2 percent, if I lookout, say, five years or so. But I do think the more I'm conclusion also from a policy perspective is the uncertainty, and the takeaway that I think we all very much share, all of the authors of the paper is that, this is quite a strong reason for, you know, waiting until the economy sends a strong message that normalization is really appropriate.

MR. WESSEL: John, let me ask you about that. So, you tell us that you are convinced that the natural rate of interest, inflation adjusted is zero. You tell us that you see no signs that it's going up. You and Orphanides, in the past, have written that at a time when there are misperceptions of natural rates, and we take account of private learning and stuff, that there should be a lot of inertia, and there should be aggressive responses to inflation. In this case we have inflation well below target. In light of all that, why would you want to raise rates in December?

MR. WILLIAMS: So that is what we call a leading question.

MR. WESSEL: Okay.

MR. WILLIAMS: So, I think that -- First of all, let me clear, and I think that -- but I'll let Thomas speak for himself here. I am not arguing that my best estimate, which is how, Jan, I think answered the question. My best estimate is zero. I'm saying that we ran this, we create this model, for exactly this purpose 15 years ago, back when people actually saw the natural rate of interest was more or less a constant, and we were saying, well, probably that has changed over time.

And that model, as we updated and continued to analyze it's telling you it's zero. I think these other papers that I've been -- you know, there are a lot of papers on this now, including the papers by the IMF and Mike Kiley and others, you know, argue that maybe the numbers one, or one-and-a-half, so I see this as more of a warning, if you will. A red flag that there's something going on here that isn't really in our models, you know, we really maybe don't understand as well as we think, and we should do, as Maury said, dig down deeper and try to figure this out better, and understand why not so well.

Now in terms monetary policy, I do. I've written on this so many times, I was kidding on that -- I've got such a paper trail, and unless I -- I can't walk away from that, and I won't. I think the zero lower bound, and uncertainty tells you to do a lower for

longer policy, it tells you to have these kinds of rules that respond either with inertia or different rules. It's that Athanasios and I talked about in our 2002 Brookings Paper.

I think that the question then is, you know, it's then a judgmental assessment of how much uncertainty there is. I think we've been lower for longer for quite some time already, relatively standard benchmarks, and I'm not going to just chose the Taylor Rule, but a lot of benchmarks or policy would have had its rates raised quite some time ago. I think we are, in my view, taken the lower for longer policy, we are, I believe taking into account, all of these different things. So the question then is, you know, again, judging all the economic outlook, and judging the risk of that, all these factors, you know, let's try to this policy right.

But this is definitely inside -- this is the kind of analysis is, I think, important for thinking about policy. It doesn't necessarily tell you -- as some commentary said about this paper, there is no obvious what we should do, I think it's an import into thing about what we should do.

MR. WESSEL: Maury, do you have a view on that?

MR. OBSTFELD: Well, I'm not going comment on Fed policy.

MR. WESSEL: I would have loved talking about Fed policy with this.

MR. OBSTFELD: I think that we've said plenty on that, so everybody knows what our official position is.

MR. WESSEL: Isn't it nice to be an institution where you are encouraged to criticize the Fed, instead of being at the CEA, where you are not allowed to admit they exist.

MR. OBSTFELD: You know, it's been hard for me to get out of CEA mode and realize that, I can talk about monetary policy, I can talk about exchange rates, because we weren't able to discuss exchange rates either, that was the Treasury --

MR. WESSEL: We'll get to that later.

MR. OBSTFELD: Like Ken say, like anything I want --

MR. WESSEL: We'll ask everybody for their estimate where the dollar is going to be three days from now.

MR. OBSTFELD: You know, I tend to actually -- The CEA Report which I played some role in last year, you know, took the view that, you know, the new normal is probably lower rates. And that's reflected in the -- Anna mentioned the 2016 budget, that's something we worked on. But I tend to sort of find myself where Jan is. I'm not a stagnation-pessimist really, about technological growth, about the possibility that there can be recovery, and will that work with demand.

So I think rates are low, I think they are going to be low for a while, but I don't really see it as a permanent state of affairs. There just other forces that are pushing toward more aggregate command in the world. But it's going to be a while. I mean, most emerging markets are facing really severe headwinds, and China's adjustment to its rebalancing, is having external effects that are far greater than we would have forecast.

You know, the Fed's normalization has got a lot of people subject to the jitters, I feel that when the Fed, you know, makes its decision it will be at a time when the U.S. economy can deal with it, and the world economy can deal with. And I think it's interesting that a lot of emerging markets policymakers have been criticizing the Fed or not raising rates. So, I think, you know, for the Fed it's going to be important to -- when they do raise rates to be very transparent about what's going to affect the path going forward, how quickly that's likely to happen. I just don't think it's going to be cataclysmic event that some were telling.

MR. WESSEL: Jan? Now would you take this analysis and say this is an argument for waiting even longer than we've waited so far?

MR. HATZIUS: I would, yes. I mean -- so I think it's -- If you look at the sort of implications of uncertainty around the equilibrium rates following an inertia, Taylor Rule that John talked about that we looked in our paper as well. I think that's an argument for waiting into 2016. I also think if you do bring in other factors, as in the Kiley Paper, say, the risk spread are more broadly financial conditions, that's also an argument for waiting longer, because it basically says, the markets have already done some of the tightening that the Fed normally tries to achieve.

And so you don't need to deliver as much on short-term interest rates, because financial conditions are clearly tighter than they were six months ago. Now some of that has reversed, so the conclusion is not quite as strong as it would have been in September, but I think it still pushed us in that direction, so that will be liable to come out of it.

MR. WESSEL: Can you give that microphone to Anil, because when I changed the Panel I squeezed him off inadvertently, and I didn't mean to do that.

MR. KASHYAP: It's okay.

MR. WESSEL: Can you stand up, Anil?

MR. KASHYAP: Yes. So, I guess there is one thing that's been nagging me, which is, everybody too, the 2 percent inflation credibly. I checked, I think the 10-year note was 215 before John and Maury spoke, maybe they moved it. It's kind of hard to reconcile that you've got this credible inflation target, you've got this very low tenure note. Let's accept that the real rate is low, it's certainly uncertainty, which means there should be a risk premium in there.

And so I think, counter to the arguments that Jan made, there is this question of how quickly that's going to revert to equilibrium, I don't think any of these guys would say 2015 is a credible 10-year bond rate. So that's something we don't

understand either, to add to your list, but there is gross inconsistency amongst this constellation of prices.

MR. WESSEL: So where does that lead you as a -- to do if you were policymakers?

MR. KASHYAP: I would get off, and see a little bit what it does. I mean I think the sooner you can two-way risk back into markets, the more likely we are going to get there, and the question will be whether it has to overshoot or not. But to me that's an argument for at least, changing a bit.

MR. WESSEL: Thomas, unless you want to comment on current Fed policy, I wanted to ask you a different question. A number of people have mentioned that when you think about the world going forward, and you really want to decompose what's going on with the natural rate. How much of it is influenced by a depressing view on productivity, and how much is a consequence of demographics; which, as Louise said are not only an American phenomena? How do you even begin to think about this? And how do tease out the two components?

MR. LAUBACH: So, I'd say we tried in our approach to control separately for that one factor. I think we are keenly aware of the uncertainty around our estimates. I think it would be fascinating to try and extend this actually, this type of analysis to longer samples, more countries as the other paper has started to do, to see whether we find some correlations over longer horizons.

One issue that we briefly touched on in our papers that we think about, is there any evidence that these real rates stay consistently low for a long period of time after financial crisis? And our first path, we are actually not able to piece that out. That said, it's conceivable that this financial crisis, as Ben Bernanke has argued, it has been much more severe than anything that we've seen before in this round, and therefore may

have had a much longer imprint.

I'd just, in general, point out, I mean we as economists need to be suitably humble whenever we talk about long-run, it's persist now as a permanent. At some point we are just missing the data to make confident statement about this is going to last 5, 10, or 20 years. It's just very difficult for us to predict, because we don't have that many observations of the long run.

MR. WESSEL: Right, but it's important to know, whether is a passing phenomenon or a signal of something really serous going forward?

MR. WILLIAMS: Let me add, I don't think it's as important right now that we answer this question definitively, and here is why. There is a lot of argument, you know, you could say between our two papers, is it growth or is it not? But there's a lot of consistency, I believe, and please correct me if you disagree, across the literature that at least the effective shorter-run natural rate of interest is very low right now. You can look at DSGE models, you look at our own analyze, you can look Kiley, and a lot of other papers.

So, at least for the next couple of years, I think there is a pretty consistent story that the headwinds are very significant, hold back growth, and the natural rate of interest is lower than normal. I think that's actually a common theme. Then the question is, will be that true seven years from now, and to what extent is that true? I we are going to have to collect more data and give more evidence and actually do more research on this.

But in terms of the policy implications, I think there isn't a lot of -- there isn't really a divide between people saying it's 2.5, and saying -- you know, sticking with that. I mean, pretty much everybody I would say, Jan, you would agree that at least over the next couple years the effective short-run natural is depressed because of the

headwind, right.

MR. WESSEL: Well, in terms fiscal policy, Maury, what does imply to fiscal policy around the world ought to be now?

MR. OBSTFELD: You know, I actually put a fair amount stock in Larry Summers' argument that, you know, if you think about infrastructure investments which in many countries that have a high marginal product, this is a really good time to make that, you know, from the national perspective, to borrow at zero, and you invest in something that's productive, that's a net gain. You know, what prevents countries from doing that? Well, you know, I would take the position that it's mostly the accounting framework that you use for thinking about public debt. You know, it increases the gross public debt.

But if you take a look at the consolidated public sector it's a winner. That kind of thing shouldn't prevent governments from doing economically beneficial investments, but unfortunately the way fiscal accounting tends to work, it's strung up as a political barrier. From the economy standpoint, it's kind of a no-brainer.

MR. WILLIAMS: You know, I agree with his point. I think that, you know, we are sitting there, monetary policy can't solve structural problems, it can't solve long-term problems, we have to focus on what we can control, normally incur in short run, a kind of cyclical policy. But this is an area where if the natural rate of interest even is 1 percent, we don't have to go down to zero.

The implications for monetary policy I think are pretty significant and, you know, if could come up with a better fiscal policy, a better -- you know, find a way to have economy grow faster, or have a stronger and natural rate of interest, then that takes the pressure of us to try to (a) come with other ways to do it, like through large balance sheet or having a higher inflation target. But it also means that we don't have to turn to quantitative easing and other policies as much. So, you know, this is, I think, an

incredibly issue in terms from monetary policy, and obviously not just the U.S. I mean this is true, around --

MR. WESSEL: Let me ask you one final question, John, before we turn to the audience. As you know there's this Bill pending in Congress that would write the Taylor Rule into law and require the Fed to explain when it deviates from it. And the Taylor Rule which is a kind of rule of thumb or formula for the Fed setting interest rates, relies on know what equilibrium rate is. So given what you know about -- what you've learned about the natural rate, do you think it's a good idea or bad ideas for this legislation to require the Fed to measure itself against the Taylor Rule?

MR. WILLIAMS: Another leading question from David Wessel.

MR. WESSEL: It wasn't leading.

MR. WILLIAMS: Yes. This is a very bad idea. I would say I found the Taylor Rule a very useful, and all the variances of the Taylor Rule, the thousands of the Taylor Rules, again, let a thousand Taylor Rules rule. It's terribly useful. I've done a lot of research on that, we analyze that, we think about that, it's really helpful to think about monetary policy strategy, think about you had -- you know, the zero lower bound issues, a lot of different issues.

But in terms of this -- even just on this narrow issue of the natural rate of interest, I think the two things I learned from both my experience, but also research is, the natural rate of interest is not a constant. I think everyone agreed on that. We don't know what it is, but it's probably not constant over decades, they are just legislating that it's, too, would be very negative.

And the second is, one of things Athanasios and I learned is that, when you don't understand the natural rate you don't want to be following the Taylor Rule, the standard Taylor Rule performs poorly in an environment where you are very uncertain

about the natural rate of interest. And honestly, the natural rate of unemployment, which we haven't talked about, but there's just as much uncertainty about that concept as this one.

And so the Taylor Rule is a great benchmark, it's a great thing to keep in mind, but clearly in a real-world environment, even on this one dimension it is not up to the task for thinking seriously about implementing monetary policy, and that's not even getting to your other issues around the rule.

MR. WESSEL: Anna, do you want to make a comment, or ask a question.

MS. CIESLAK: No.

MR. WESSEL: No? Louise?

MS. SHEINER: Not now.

MR. WESSEL: All right. Let me start with Ken or Ethan, and if the others want to land.

MR. HAMILTON: Jim Hamilton again (crosstalk).

MR. WESSEL: Just stand up in front, for the cameras.

MR. HAMILTON: Yes. I just wanted to emphasize one very important common ground between the two papers, which is a lot of theoretical models assume that R-star is constant, and we've found a lot of evidence that it's not constant, and an important implication of that is, if it's changed before, it can change again in the future. If your Z is around the block your current forecast might be as current level, but it could vary quite a bit from where it is now. That's kind of what we are talking about with -- about the censor and the issue.

MR. WESSEL: Mm-hmm. Good point. There's a question there on the aisle, and then maybe you can give -- The guy with the blue shirt, if you stand up. And

Brenda, why don't you give the mic to -- Okay.

QUESTIONER: Thank you. Larry Jago. I'd like to simplify this just a little bit, but if NRI is so determined by growth, I'm surprised nobody has talked income and equality in this conversation, and the fact that, you know, perhaps the 1 percent is sapping up so much of the money out there, that if you really want growth people aren't going to buy stuff unless they have money and -- You know, it's obvious, I don't think I have to explain it anymore than that.

MR. WESSEL: So, I think, when Ken put up his list of 12 things, we are now up to 15. What role does inequality quite --

MR. WILLIAMS: Well, it's actually broader. I mean, and this is something Larry Summers has talked about, and that's the fall in labor share, a lot of these kinds of secular changes in income distribution, labor share, these do feed through, potentially, into that simple IS curve that I talked about, and can be shifters. So, again, that list is very long. We don't have good quantitative evidence about how big the effects of those are, but I agree that there's a lot of things that are shifting, both the IS curve and potential output.

MR. WESSEL: Christian?

MR. WILLIAMS: You are not going to ask when we are going to raise rates, are you?

QUESTIONER: I already did that for you. I got that out of way.

MR. WILLIAMS: They won't stop, you know.

QUESTIONER: They already did that.

MR. WESSEL: Christian has a way of asking long questions, you'll have a long time to think about that.

QUESTIONER: I'll keep it short today. For John and Thomas; how does

your framework help you to think about the role of the dollar? Is this something that could keep this on natural rate below a longer equilibrium? How would you think about potential longer-run implications for a steady state?

MR. WILLIAMS: This is specifically about the value of the dollar today? QUESTIONER: The footnote, that's the point in (inaudible).

MR. WILLIAMS: Yes. Okay. So, you know, I'll tell you that this was not the only project I have worked on, on measuring the equilibrium real interest rate at the Fed. One of the things working off, Antulio Bomfim, one of my former colleague's work, using the old MPS model, I worked on projects using FRB/US model, and what you try to do there, is you basically try to unpack, if you will, all of the long-run factors that are on the right side -- you know, that are driving aggregate supply and aggregate demand.

And obviously the non -- the endogenous movements of the exchange rate that are part of the business cycle, that's all business cycle fluctuations. We try to pin down term premium, equity premium, sovereign risk premium, all those. And so, you know, you do that kind of -- we've done that kind of analysis, and clearly that would tell you that all else will equally stronger dollar would depress, again, all else equal and thinking about this is a long-run phenomenon, would depress aggregate demand somehow.

The issue with there, is you end up with 40 factors, I think, that push around the natural rate, and of course all of them are subject to a great deal of uncertainty, and it was hard doing that method of aggregating lots of different things to know, kind of what were the -- how much uncertainty and kind of robustness was around that. But that's the way I kind of tended to think about it.

And the thing that you have to be very careful about, looking at asset price is, asset price is, like everything, or endogenous variables, and so if the Fed is -- in

a cyclical sense, if the Fed is moving one way, or expected to move one way, and the ECB moves another way, that's going to move these variables. The question we want to know is, 5 to 10 years from now, where will these things land.

MR. WESSEL: Anybody else wants to weigh in on that?

MR. OBSTFELD: Yes. I mean, the other aspect of your question, and maybe what you are also getting at is not the dollar is level but the role of the dollar in the international system. So I don't want to speak for Ben who is not here, but he would probably say something like, you know, if you look at that period from 2000 to 2007, where real rates don't really come back' you know, part of what was going on was central banks in the emerging world accumulating dollar asset, pushing down dollar yields.

You know, how important is that empirically? There's some evidence that it explains, you know, 50 to 70 basis points, but again, that's an area that is uncertain and probably doesn't explain as much of what's been going on since the global financial crisis.

MR. HATZIUS: I would just say that the dollar, or more broadly, financial conditions are important for monetary policy, so when financial conditions move then that can have implications for monetary policy to go in the other direction. And once again, I think that's one potential reason to wait a little longer in terms of -- in terms of the liftoff.

MR. WESSEL: Did you have -- can you stand?

QUESTIONER: Yes. And one of the reasons to go earlier just in case I -

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MR. WESSEL: Can you stand up for the microphone?

QUESTIONER: Tell me a reason we are supposed to go earlier?

MR. WILLIAMS: One is imbalance.

MR. HATZIUS: Yes. I think that the labor market slack has diminished a

lot and the (inaudible) continues to come down quickly.

MR. WESSEL: Peter?

QUESTIONER: Just to comment on a question. John, you said at the beginning that this was a paper about Z and not about growth, and that comes through very clearly in your chart 6. You are actually fairly optimistic, I think, about where potential growth is currently, about 2.25 percent.

A case could be made, it could be considerably lower. But my question is -- Oh, and that, by the way, drives, zero not a factor, you natural rate would be close to 3 percent now, given your coefficient I think. My question is -- take 1.3 as a coefficient on potential growth --

MR. WILLIAMS: Right

QUESTIONER: Okay. My question is, in determining movement in the (inaudible), it's basically the slope of the IS curve, to what extent is the model you are using one that could have changed over time? Has interest sensitivity, that sort of thing.

MR. WILLIAMS: Sure. Yes. Peter, that's a great question. We are estimating them all from 1961 through 2015. The U.S. economy has changed in many respects, and I think, was the more you brought up the issue of anchored inflation expectations, or inflation expectations. So one thing we've played around with, you know, we've spent a lot of time in the lab, in my "free" time, on the weekends, trying different specifications around the inflation process, around other aspects of the specification, and we found that, again, the point estimates change, there's no question as you -- you know, we specify the model, you get slightly different point estimates.

But the thing that comes out every single time is this point that Maury actually, thank you, made, because it's in the papers, there are two ways of declines of the natural rate. One between 1990 and 2007, which was a modest, or moderate decline

and then just plummeting after, and that comes through pretty much anyway, anyhow, any attempt we do on the model.

I will say something about what you just said about, that if it wasn't for Z, R-star would be 3. That's not actually true, because we did run that experiment, and it's kind in with the Fleischman-Roberts thing, is as long if you allow us to estimate that coefficient of C, the data scream that the natural rate is low today. That's what the data want, they want it any way you can get it. So, when I get rid of Z, what happens is the coefficient of G-star goes up to 2, R-star still comes down because it's just going to try to -- you know, the data is trying to get it in there, and with the slowdown in productivity -- potential growth. That's the way it happens. I will tell you there's a really nice paper from the Richmond Fed, Thomas Lubik and -- I forget the other --

MR. LAUBACH: Christian Matthes --

MR. WILLIAMS: Yes -- Matthes. And what they do is they do a stochastic volatility time-varying parameter, kind of model, you know, the fanciest Bayesian estimation with all -- everything moving around at once. And they estimate that model, and they end up with estimates of the current natural rate of interest, which are not zero, I think it's about 0.5 percentage points, around there. It's a little bit above ours, but it's very consistent with ours over the last 35 years.

So that gives me a little bit, you know, we mentioned this on paper, a little bit of confidence that maybe our model -- our model is wrong. I mean, any model you right now is wrong, but when you do it in all these different ways, you kind of find the same patterns.

MR. WESSEL: Does any model predict that the rate will return -- rise again?

MR. WILLIAMS: If you assume.

MR. WESSEL: If you assume it, okay. Jason Cummins, in the back --

MR. CUMMINS: Thank you. Jason Cummins.

MR. WESSEL: I want to (crosstalk)

MR. CUMMINS: Now, normally a question -- I'll ask a question, but I'm actually going to answer a question that was posed which will present a little bit of discussion. So, David's first question was about why are rates -- what's the rationale for raising rates if the paper has R-star estimates of zero? I would have answered, if I were sitting in John's spot, perhaps he's constrained in some way. I would have pointed out, R-star is zero in that model, but the output gap is also zero in that model.

So, what should rates be in that framework? Well, they should be at equilibrium, because the model basically is an equilibrium. Real rates right now are not zero, they are negative, if you balance sheet adjust them, given that there's a large balance sheet they'd be even more negative. So rates right now in that model, if you spit out a rates path, actually has nominal rates going up a bit, higher than they are here.

So, I would have answered the question a bit differently by saying, that, yes, rates are low in that framework, but they are above even where they are now with the natural rate of interest at zero because they have a zero upper gap.

MR. WILLIAMS: I agree with most of what you said. I think that if you are thinking that this is a Taylor Rule, it would tell you the intercept of the Taylor Rule is zero, and core inflations are only at 13, so you would be at 13 for funds rate, if you are at kind of starting point. Then there is the coefficient and the inflation and upper gap. And I agree the upper gap is relatively small, you know.

But the inflation term, we are below 2 percent inflation. So the reason I didn't want to go into that, is it really depends on your views on -- I would say, what's your response to inflation, and all that, but your basic I think, you know, it's valid. It would tell

that the equilibrium nominal funds rate is -- even in our estimates will tell you it's 2. And assuming we were in equilibrium, you know, we wouldn't stay at zero interest rates forever.

MR. WESSEL: Maury.

MR. OBSTFELD: Yes. I mean, the great danger is that, like we are at the zero bound, we are not in the standard Taylor Rule situation, and inflation has not risen to its starting level. So, what if you raise the interest rate, the nominal interest rate and the economy worsens, and you get more deflation and the real interest rate goes up? I think that's sort of a nightmare scenario that people worry about when they say that -- you know, they are risks the Fed should rate.

MR. WESSEL: Mr. Rowe?

QUESTIONER: Thank you. Isn't the real problem growth, and the way you get growth is by moving money, velocity, that it's wonderful that Congress has come up with a budget that plans to spend all of one month's worth of quantitative easing. We've had a real problem where we have paper and a lot of money caught up in paper, financial instruments. The financial crisis wiped out some unknown amount of money, but the real issue is getting money out of the banks where it does nothing, and getting it into the economy where it might trigger some growth.

Corporations sitting on mountains of cash don't go to the banks looking for loans, they don't need it. But if they can't get that cash, if they don't have ideas for getting the cash into the economy where there might be growth, maybe that's a role for taxation.

MR. WESSEL: I mean -- I think there's agreement here that we --

Thomas?

MR. LAUBACH: There's agreement that fiscal policy could be more

constructive.

MR. WESSEL: Go ahead.

MR. LAUBACH: So, one thought that's triggered this, of course, what was observed earlier, that we may be in a period where we are actually, we have an unusually high degree of risk aversion that may last for a long, long time. And the factors that you mentioned may be a manifestation of that very high degree risk aversion; that maybe people felt they got burned very badly in ways that they had never imagined before during the financial crisis, and this is just leaving a very long-lasting imprint on various types of economic behavior.

MR. WILLIAMS: You know, I actually do believe that, you know, those kinds of factors are affecting aggregate demand, and if I can stick to ECON 101, kind of ideas here. I think they are affecting aggregate supply too for these reasons, you know, risk taking is less, investment, you know. I live near Silicon Valley so I can't actually believe this, since everyone is inventing a new world every week. But, you know, it may be depressing investment, innovation and things, and lowering potential output.

The problem is, to the extent that, you know, we've tried very hard, through monetary policy, to create greater risk taking, to basically reduce interest rates and cost of capital, I think, you know, we can debate whether monetary policy has been optimal or not, but there's no question that we've done enormous measures for accommodation, and for actually our balance sheet, low interest rates for seven years.

So, to me, some of these things are outside the control of monetary policy, the risk appetite, you know, the firms sitting on cash as opposed to investing in productive capacity, and increasing aggregate supply. I think the fact is, it's that, you know, plus or minus 1 percent, we are close to -- output gaps are relative small today, so it's not just demand. If you are really thinking about why isn't the economy growing

faster? You know, we could say that some of it is demand, but I think a lot of it is actually the supply side of the economy, it's just not growing very rapidly, and that is a demographic, in part too.

MR. WESSEL: Anil, do you want to take a shot? No? Okay. With that, please join me in thanking all our Panelists and Presenters. (Applause)

As I mentioned we will be discussing the How the Treasury Borrows on November 10th, at the University of Chicago, we welcome your involvement in that. My colleagues at Brookings would appreciate it if you look to your feet, pick up the papers and coffee cups, and put them in the recycle in the back. Thank you very much.

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