

THE BROOKINGS INSTITUTION  
WHAT'S (NOT) UP WITH INFLATION?

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MR. HUTCHINS: Good Morning. Good morning. My name is Glenn Hutchins, and I'd like to welcome you to the event today. The mission of our center is to improve the quality of both monetary and fiscal policies, and, in particular, the public understanding of it, under the very leadership of David Wessel, here, in the front row.

We've worked to promote analytical rigor, but also to make complex questions understandable, accessible and relevant. Today's event speaks to all elements of this mission. Today one of the most vexing questions confronting the Fed, and even more so, other Major Central Banks, and to depart from my script for a moment, also people who participate in markets, but that's a different part of the world, is that inflation has stubbornly refused to rise, much less persist, at the two percent target, even as the U.S. and Global Economy has recovered from The Great Recession. Key question is, why? While history will be the judge, once the data has been interrogated, we don't have time for that because today's policymakers and investors need to act, and to do so require at least a rudimentary answer to this puzzle.

Today, we have gathered some of the leading experts in the world to explore the various explanations. Inflation didn't fall as much during The Great Recession, as the models anticipated, and hasn't risen as much lately. Is it dead, or is it just dormant, or is it -- and to paraphrase Mark Twain, has this death been much exaggerated? In my experience, and one of my rules of investing, is widespread capitulations is the first sign of the bottom, and is that kind of where we are right now?

Has Monetary Policy been so successful, inflation expectations are, as economists like to say, well anchored, perhaps too well anchored? Have globalization and technology, not just Amazon and Alibaba, also, almost perfect priced transparency and frictionless converse made raising prices difficult? Has the Global Labor Market changed in some fundamental way, particularly as a consequence of not just globalization, but also technology, as we discussed earlier? Has the economy evolved in ways the models simply haven't been incorporated? Heaven forbid the models might be wrong, and are we at an inflection point in the transition from an industrial to an information economy, in ways we cannot, or do not yet know how to measure, and, finally, should the Fed incorporate answers to these questions, as it pursues full employment and price stability?

We'll start the agenda today with Janet Yellen. If you need an explanation of who she is,

you probably shouldn't be here, but Janet will set the stage, and then, as you can see in your agenda, I think everybody should have an agenda. We'll focus on a few of the leading explanations for the unanticipated behavior of inflation, and then turn to the implications for policy.

Many of you know, that after the distinguished career at the Fed, including four years of German, Janet is, now, a Distinguished Fellow, here. While many of us, notably me, thought she marred to the second term, the Fed's loss is our gain. Janet, it's yours.

MS. YELLEN: Thanks so much, Glenn. It's my pleasure to join Glenn in welcoming you to the Hutchins Center Conference on inflation.

My objective is to prepare the ground for today's presenters, by describing the puzzle we'll be discussing, and highlighting why the answers matter for policymakers and for economic performance. The main puzzle pertaining to inflation is aptly summed up by the title of this conference. What's not up with inflation?

Inflation hasn't moved up to an expansion that, now, ranks as the nation's longest on record; unemployment decline from about 10%, in 2009, to 3.7% today, a 50-year low. Yet, headline inflation over the last year, according to the Federal Reserves, preferred Personal Consumption Expenditures, or PCE Measure, stood at only 1.4% in August.

Core inflation, which excludes volatile food and energy prices, came in a bit higher, at 1.8%, but the current pace is close to that in 2009. Contrast this experience, with that during the long expansion of the 1960s. Unemployment declined from 6.7%, in 1961, to 3.6%, in 1969. Over the same period, headline PCE Inflation rose from just under one percent to roughly five percent, and core inflation increased by a similar amount.

The Phillips Curve has long served as the workhorse model of inflation, and it's used by most economists, including Federal Reserve Staff, to analyze and forecast inflation trends. It posits the current inflation, depends on the degree of labor market slack, on lagged inflation, and on a variety of supply shocks, including those affecting the prices of food, energy, and other commodities, and the value of the dollar, which affects import prices.

Various transitory factors, or noise, also affect inflation readings. The comparison, I just described, concerning the behavior of inflation, as unemployment declined during the current expansion,

and that of the 1960s, illustrates two robust empirical findings.

First, the slope of the Phillips Curve, a measure of the responsiveness of inflation, to a decline in labor market slack, has diminished very significantly since the 1960s. In other words, the Phillips Curve appears to have become quite flat, and, second, inflation has become much less persistent because the impact of lagged inflation, on current inflation, has declined considerably. This likely reflects the fact that inflation expectations, which affect wage and price setting, now appear to be quite stable and unresponsive to variations in actual inflation.

Inflation expectations, in other words, have become well anchored. During the 1960s and 1970s, in contrast, a rise in actual inflation appeared to boost inflation expectations considerably. Higher responsiveness of inflation expectations to actual inflation works to boost the longer-term response of inflation to changes in labor markets slack, considerably. In fact, it creates the possibility that a temporary decline in unemployment, below the natural rate, were a transitory supply shock, results in the permanent increase in the rate of inflation, as so-called acceleration as Phillips Curve.

An important question is just why the relationship between inflation and unemployment has become so attenuated. In the view of some observers, almost nonexistent, and our presenters, today, will consider some possibilities. One possibility is that labor markets slack is not appropriately measured by the civilian unemployment rate. Perhaps broader measures of slack, including, for example, individuals involuntarily working part-time, where some, who are considered to be out of the labor force entirely, are relevant to wage and price inflation.

The willingness of individuals considered to be out the labor force to enter, in response to strong opportunities, may also restrain inflation. Prime age labor force participation has declined considerably in the United States. It moved up during the expansion, but, even now, remains roughly half a percent below its level, just prior to the Great Recession. Another possibility is that that the flatness of the Phillips Curve reflects downward rigidity of nominal wages.

Firms are generally reluctant to impose wages cuts on their employees, and, during the early years of the Great Recession, wage inflation fell very little. Perhaps, for this reason, both wage and price inflation were restrained during the recovery. The flatness of the Phillips Curve might also reflect global influences with trade slack and foreign economies, in the prevalence of global supply chains,

attenuating the influence of domestic factors, on inflation.

Conceivably, the flattening of the Phillips Curve reflects technological or market structure factors, such as the ease of price comparisons over the internet, resulting in declining pricing power for domestic firms. It's also possible that the flatness is a statistical mirage. The success of policy makers, in achieving low and stable inflation, in part by accepting higher unemployment when supply shocks are pushing inflation up, could be masking a true relationship between inflation and unemployment that is stronger than it appears to econometricians.

Finally, the success of policy makers in holding inflation low and stable, in recent decades, could explain the decline in persistence of inflation, which, in effect, flattens the slope of the longer run Phillips Curve. Longer term inflation expectations, as measured, for example, by the survey of professional forecasters, have been remarkably stable in the vicinity of two percent. Such well anchored inflation expectations may have been fostered by the Fed's adoption of a numerical inflation objective, of two percent, in 2012, preceded by a long period, during which the Fed was committed to, first, bringing inflation down from unacceptably high levels, and then maintaining inflation in the general vicinity of two percent.

Well, what difference does it make, from a policy perspective, if the Phillips Curve has flattened, and if inflation has become less persistent? If the Phillips Curve is very flat, and if inflation expectations are insensitive to fluctuations in actual inflation, the Federal Reserve may be able to the economy hot, yielding significant benefits to workers, while imposing only minimal costs on society, in terms of higher inflation.

Indeed, given that inflation has been so very low, for so long, it's averaged only 1.5% over the last decade, it may be necessary to have a hot labor market, for inflation to move back to 2% on a stable basis. Allowing the Labor Market to run hot could bring substantial benefits. As Brookings Economist Arthur Okun observed, in 1973, in an early volume of Brookings Papers on Economic Activity, a high-pressure economy improves upward mobility, and we're seeing that in the current expansion. Those who are least advantaged in the labor market, those with less education, and minorities, are experiencing the largest gains in wages and declines in unemployment. Moreover, when firms find it hard to hire, they tend to lower qualifications, and provide more training.

We're seeing more partnerships with community colleges, and local governments, to develop job market programs, with promised employment with those who successfully complete them. In slack labor markets, those who check the box, indicating criminal a record, have little chance to find work. Their resumes quickly end up in the circular file. In today's strong labor market, that's changed somewhat, and individuals, such individuals, are getting a chance to turn around their lives.

It's possible, albeit uncertain, that the skills and experiences, these individuals are acquiring, in today's tight labor market, will yield longer run benefits, enabling them to do better, even if the economy experiences another downturn. A significant benefit of bettered anchored inflation expectations is that they enable the Federal Reserve to all but ignore the inflationary impact of supply shocks, in their conduct of monetary policy, mitigating the need for monetary policy to tighten when negative impacts on employment, following adverse supply shocks.

Well anchored inflation expectations, in effect, mitigate what might otherwise be painful conflicts between the Fed's inflation and employment objectives. Indeed, over the last decade, U.S. Monetary Policy has barely responded to movements in inflation driven by oil prices, the dollar, and others supply factors.

For example, after a multi-year sequence of unanticipated oil price increases, between 2004 and 2008, inflation reverted to its previous trend, once oil prices stabilized. Similarly, inflation moved back up to two percent in 2018, after several years, in which declines in oil prices, and a marked depreciation of the dollar, pushed inflation below the Fed's target. In contrast, in 1973, and again in 1979, oil prices jumped markedly, producing sharp inflation spikes. In those episodes, inflation appeared to move permanently higher, even after oil prices settled down.

It's important to point out, though, that a flat Phillips Curve has a downside, which is that it raises the so-called sacrifice ratio. The sacrifice ratio measures the cost, in terms of higher unemployment, to lower inflation, should it rise too high. With a flat Phillips Curve, it's necessary for monetary policy to create a good deal of slack in the labor market to return inflation to levels consistent with price stability, and if the flatness of the Phillips Curve is a statistical mirage, rather than a true change in the economy's structure, an attempt by policy makers to exploit it could push inflation up much more than they expect.

Finally, even if the Phillips Curve is quite flat over some range, it's conceivable that it could become a lot steeper, if unemployment is pushed to very low levels, that is, it may be not linear, at very low unemployment. There is some evidence of such non-linearity. So, it's a significant policy concern. Another policy consideration pertains to inflation persistence. Can we count on such low persistence going forward, or might inflation revert to its earlier behavior, if policymakers attempt to exploit the current benign inflation dynamics to keep unemployment very low, or push it yet lower?

If the decline in inflation persistence reflects increased credibility of monetary policy, this valuable asset could be squandered if monetary policy consistently allows inflation to deviate from its two percent objective. As in the 1970s, a willingness of the Fed to tolerate inflation persistently above two percent could ultimately de-anchor and boost inflation expectations. Alternatively, and arguably the more relevant consideration, today, a chronic failure of the Fed to stably achieve its two percent target could de-anchor inflation expectations on the downside, exacerbating the problems associated with the effective lower bound on policy rates, in creating significant deflationary risks.

Well, to conclude, our panelists will address questions that are vitally important for economic policy and performance in the years ahead, and I look forward to today's discussions.

MS. LIANG: Thank you, Janet, of course. Thank you for joining us for this morning. So, I'm pleased to present, to start with, the two presenters for our first panel on What's not up with inflation, and that is: It's All About Monetary Policy, and It's All About Inflation Expectations. So, we are very fortunate to have two presenters, first Silvana Tenreyro, Tenreyro, Professor of Economics at LSE, and, of course, an external member of the Monetary Policy Committee, for the Bank of England, and, so, you -  
- put this -- her work in practice.

Second, we have Michael Weber, is an Associate Professor at the University of Chicago, who has done very innovative aluminous research on how households form inflation expectations. So, without further, I'll just let -- have Silvana start.

MS. TENREYRO: Thank you for having me, and, as Janet Yellen just said, in the past few years, several academics and petitioners have observed that the Phillips Curve, the relation between inflation and measures of slack, has flattened, or even disappeared. Some studies even highlighted that inflation appears to follow a totally exogenous process unrelated to those measures of slack, such as



unemployment, or the output gap.

This led some academics to argue that the disconnect, between inflation and measures of slack, poses a big challenge to the monetary policy framework, currently used by major Central Banks, like the Fed, which uses the Phillips Curve as a key building block. So, my work Michael McLeay, at the Bank of England, we asked the question does -- this is connect between inflation and measures of slack really pose a challenge to the monetary policy framework, and our answer is no.

On the contrary, the disconnect between the inflation and unemployment, or the output gap, it's actually what a new cage and framework, like the one used in Central Banks, with the Phillips Curve, and the Central Bank, that has a dual mandate, as in the Fed, would actually predict, and let me try to make my argument to send a simple variation of the new cage and framework used in the Central Banks.

So, our Central Banker has a dual mandate, with a remit of achieving and inflation target, and full employment, or output at its potential, and this is represented here by the simple formula, that says that the Central Banker minimizes the deviations of inflation from its target, we noted here by  $\pi$ , and deviations of output from its potential,  $X$ , and the Lambda letter, here, captures a relative weight that the Central Bank puts on output stabilization, vis-à-vis, the inflation target. So, the Central Banker minimizes these deviations, subject to a structural Phillips Curve, or aggregate supply constraint for the economy.

The supply constraint is very intuitive. It says that when output increase is relative to its potential, the open gap increases, that puts outward pressure on wages and costs, causing prices and inflation to increase. So, the cap, here, is positive. I can't -- I can point. It's over, okay.

This Phillips Curve, in blue, here, is also coming -- also shifted around by causable shocks, such as oil shocks, or changes in firm's markups, that are collective in the term  $U$ , and it can also be affected by changes in expectations of future inflation, represented in the first term. Now, the solution to this optimization problem, by the Central Bank, is a targeting rule, depicted in red, which is also very intuitive. It says that, when the Central Bank sees that inflation is set to rise above its target, she will withdrawal stimulus from the economy, causing the output gap to fall.

This targeting rule imparts a negative relation between inflation and the output gap. So, I

plotted the two curves in this simple diagram. We see the upward slope in Phillips Curve, in blue, and, here, under the assumption that inflation expectations are anchored at the target, and there are no causable shocks, and the downward slope in targeting rule, depicted in red. Now, in equilibrium we only observe intersection between these two curves. We don't directly observe the Phillips Curve, or the targeting rule.

So, we face what, in economics, we call a classical identification problem. Now, this identification problem is made more difficult by the fact that the Phillips Curve can shifted around by causable shocks or changes in inflation expectations. So, here, in an observer, or a naïve econometrician, trying to run a regression of inflation on the output gap, will actually trace the wrong slope. We'll only see the response of monetary policy to causable shocks. So, we'll be identifying the targeting rule, rather than the Phillips Curve.

So, two lessons from here. If monetary policy successfully offsets all the main shocks, then all what's left is these causable shocks, which will trace the wrong slope, and the second lesson is that, in equilibrium, here, inflation will inherit all the properties of the exogenous causable shock. So, effectively, we will see inflation following this exogenous process, with the persistence of this process, but we won't see correlation with slack, that we would expect from a Phillips Curve.

Just a couple of more remarks on this. The moral I just presented you has a very healthy Phillips Curve, by assumption, and, yet, we cannot see it in equilibrium. The argument, I'm making here, is slightly different from the one on anchored inflation expectations reducing or weakening the reduce from correlation between inflation and slack. My argument says that, independently of inflation expectations, the structural relation, between inflation, and slack, will always be masked by the conduct of monetary policy.

Now, of course, as Janet Yellen just said, if monetary policy affects inflation expectations, leading to an anchoring, that effect will also add, or go in the same direction. So, these two effects are in -- sometimes complimentary. Let me go to -- back to the identification problem, now, and how can we see this Phillips Curve? So, ideally, what we would like, as econometricians, is to have a very stable Phillips Curve, so that it doesn't move around, where we control for a movement in that, and have deviations of -- from the optimal targeting rule, some shocks to that optimal targeting rule. In that case,

so, if we have the main shocks, that move us along the Phillips Curve, that are not offset by monetary policy, we'll be able to trace the right slope.

This is easy to see in the simple model, but it goes through in a more complex quantitative setting that -- models that Central Banks are using, as well. So, just to summarize, in order to actually see the Phillips Curve, in the data, we need to control for supply shocks. That's not simple, and it's not sufficient. It's not simple because many shocks to the economy are part supply and part demand, and it's not sufficient because, again, we need these demand shocks to move us along the supply relation, or aggregate Phillips Curve, and are not offset by monetary policy, or other policies.

Now, in practice economies, or econometricians, have used monetary policy shocks, deviations from optimal policy, due to mistakes in forecasts, or judgement, and that allow them to identify the Phillips Curve. Now, interestingly, those monetary policy shocks, or fortunately, I should say, have become very small and infrequent since the '90s. So, it's much more difficult to use them to identify the Phillips Curve.

What we use, in my work with Michael McLeay, is the segregated data, the segregated that the regional level, in order to identify the Phillips Curve. The idea, here, is that monetary policy offsets aggregate demand shocks, shocks to the whole country, but does not offset regional demand shocks. So, from the perspective of a region, monetary policy is of optimal, and the region might have an open output gap, or higher unemployment than the average.

So, we use this idea to identify the slope of the Phillips curve. Here, I'm showing the outcomes of regressions of U.S. metro area inflation on slack, from 1990s onwards. This is a period of a very flat aggregates Phillips Curve, and each regression here, with this core CPI Inflation, at the metro area level, on the unemployment rate, so, in unemployment space, the Phillips Curve is actually negatively sloped. So, it just adjusts that with the graphs I showed before. We controlled for inflation expectations and we control for lax in inflation.

Now, if we don't use any other controls, the slope coefficient will be very similar to the one we obtained with aggregate data, and it's -- speaks of a very flat Phillips Curve, with a coefficient of .15. Now, I would like you to focus your attention on the last column. Here, we control for time effect, so controlling for any arrogated supply, or demand effect, including the effect of monetary policy at the

aggregate level, and we also control for having variant regional specific effects.

Now, when we do that, the slope coefficient increases to nearly .4. So, this is a very healthy Phillips Curve, the type of numbers we tend put into our models, and it's in line with intuition from -- or the insight we get from the model, that's at the aggregate level, is very hard to see the Phillips Curve because in monetary policies offsetting demand shocks, but we can see that, by looking at regional or desegregated data for which monetary policy is not offsetting the main shocks.

So, I'll leave you with my summary. I'll like to add, just, you know, a couple of remarks. The reduce from correlation or Phillips Curve is a mix of supply and demand factors. Monetary policy is one of them. For individual episodes of missing inflation, or disinflation, such as the Great Recessions, the theory and the data point to a variety of factors. On the supply side, large causable shocks such as what we saw during the recession. Energy prices were going up, productivity fell, and there was a large financial shock. All of them contributed to higher costs and, also, pressed down on activity, and, as Janet also mentioned, there are arguments about the measurement of slack, and many people have argued that other measures of slacks has -- such as short term unemployment, for example, didn't go up by as much as total unemployment during the Great Recession. So, maybe, that one was overestimated at the time. I conclude here, and happy to take questions. Thank you.

MR. WEBER: Thanks a lot for putting together this amazing event, and for having me today. So, what I want to start out with is actually what Glenn eluded to, at the very beginning, when he said, typically, when we write on models for policy recommendation and policy analysis, we would assume that there is a representative phase, and there's all available information, forms expectations rationally, and then would, actually, whenever there's any new information, immediately update his or her expectations, and, then, accordingly change savings and consumption plans.

To get an idea, actually, where that is paradigm, given that we see large deviations, often times, in data, it's actually, maybe, a useful framework for policy analysis. We feel that, together with (inaudible) representative sample of 20,000 Americans, spread out across the whole country, just to serve you, to get an idea whether individuals have a good understanding of basic policy paradigms, and, so, what we've found, and this is, maybe, you know, a nice interpretation. So, on the one hand, you see between 20 and 30% of the average American, then (inaudible) an understanding that the Fed aims to,

maybe, achieve in longer periods of time, the inflation rate of about two percent.

So, people have an understanding, what an inflation target is, but what you also see is that this is that there's this big chunk of the population, more than 40% in our sample, that answer the number larger than 10%; some of them even as large as 50%. So, of course, now, what does this mean? So, there's a benign interpretation of this finding. Policymakers, many of whom are in the room, have done an amazing job over the last couple of decades, bringing inflation down, low and stable.

So, therefore, you know, the average American maybe doesn't care about inflation expectations on a daily basis, but, of course, there's actually not an innocuous interpretation because in times, such as now, when, you know, there's only limited space to go even lower in interest rates, and there's some, for example, see, in the Eurozone, right now, when we might run into constraints next year, on how much QE can do. Communication might be the only game in town, and if the average person does not actually have a well-understood understanding of what basic policy aims are, it seems hard that by moving to a more directive communication, you can actually, indeed, achieve, maybe, big demand stimulation by moving inflation expectations.

Now, of course, motivated, now, by this finding, we try it in some other work, together with (inaudible) to figure out what are the sources of information people would use when forming inflation expectations, and to some extent, to our surprise, the most predominant source, in a survey of 50,000 Americans, fielded, like, a few years ago, was people's daily grocery shopping experience. So, people tend to focus on the price changes they see, when shopping, to form overall inflation expectations.

To, now, directly document that in the data, we paired up with Nielsen, and, here, for those 50,000 people we surveyed ourselves, we actually were able to observe, at the daily frequency, the type of goods they purchased over the previous years, as well as the prices they did pay for those goods. So, therefore, what you can do, you can construct, similar to the Bureau of Labor Statistics, a measure of household CPI, what is actually the past inflation at the shopping bundle of individuals, and pair it up, and to see whether heterogeneity in past observed price changes does matter for inflation expectations, and what you see here, to the far left, those are individuals that had the lowest degree of observed inflation in the shopping bundle. So, their inflation expectations are about .5 percentage points lower, that the inflation expectations of individuals that had the highest past observed shopping bundle inflation.

Now, of course, you might say, well, this is already kind of surprising, given that what we see in Nielsen is only about 20-25% of overall consumption expenditure. So, therefore, you might actually even expect that, maybe, it is not that every price change is created equally, but maybe individuals might even focus on specific goods when forming inflation expectations, and that's actually, indeed, the case in the data. It's not like individuals who would actually use expenditure shares in Nielsen to weigh price changes.

Instead, actually, think about milk. For all of us in the room, milk has a tiny expenditure share, but some maybe buy milk 10 times a week, and others only one times a week, and it's indeed that the frequency of shopping seems to be determining the price changes people actually tend to focus on. Now, what does it mean for policy? Of course, there's a concern.

This might undermine policy credibility because, if you think about the inflation measure, many tend to actually focus on core inflation as an indicator for inflationary pressure, tends to actually strip off completely all those volatile price changes that, instead, the average American tend to focus on when forming inflation expectations.

Now, to get an idea whether actually, now, indeed, on the one hand, there is what might help explain this heterogeneity. There may be some observable characteristics, but also motivated by this recent theory work by (inaudible) that actually argue that maybe the reason why we see a, let's say, a forward guidance passive effect, that promises to keep interest rates low for an extended period of time, might not be as effective as our benchmark model might predict.

There has been this idea that maybe cognitive frictions may be some kind of naïve behavior, could partially help explain those differences in policy effectiveness, and, so, what we did here, we teamed up with the Bank of Finland, where we now, for all Finnish men from the military, we can observe a measure of cognitive abilities, and then, giving -- being a Nordic country, we can link, based on personal Social Security numbers, this measure of IQ, in the survey, to individual inflation expectations from the European Commission Consumer Survey, and the, also, household balance sheet, income, and all of that, to then, actually, get an idea whether, indeed, there is heterogeneity in the degree of how well people are informing expectations, how well people are in actually prescribing to the prescription of our basic models, and all I wanted -- take you away from this figure, here, if you go all the way to the far left,

those are the men in Finland with the lowest measure of IQ; to the far right, men in Finland with the highest measure of IQ, and you see, on the Y axis, the mean absolute forecast error, for inflation, and I all I want you to take away from here -- you know, there is vast differences in how well individuals are in forecasting inflation, by measured cognitive abilities, but it's -- also, then, directly translates into policy effectiveness.

What we can show in the data is that, actually, the top 50% of the IQ distribution, they've pretty much behaved as we would model them. You know, they have increased their consumption expenditure when they have higher inflation expectations. When the ECB lowers rate, they take out more loans. When the ECB actually increases rates, they lower -- take out less loans. So, they indeed actually behave as we would hope to behave. The bottom 50%, instead, does not react at all, and I think we can convincingly show, in the paper, it's not due to financial constraints.

Another potential alternative explanation, but it indeed seems to be the case, that there's a limited understanding what policymakers try to achieve, and, of course, it's then -- also raises potential concerns if we do not well communicate with ordinary people. There might be a concern of redistribution.

Now, to directly show you that there is, indeed, evidence that the complexity or simplicity of policies seem to be important for the effectiveness. I'm not just documenting some micro survey data from Germany, and two policies that are somewhat different in how much basic understanding Germans have to have to understand the policy transformations. Both of those policies rely on the consumer Euler equation. So, what does it mean?

You know, you raise inflation expectations, and then, hopefully, people start consuming more. The left policy, we -- here, what we label in this figure, Unconventional Fiscal Policy, this was when Chancellor Merkel, in 2005, was first time elected, in Germany. She announced, immediately, that she wants to raise VAT, so consumer taxes, 14 months down the line, from 13 to -- from 16 to 19%, and what you see, after the announcement, and before the effectiveness of the raise in consumption taxes, in the top panel, inflation expectations went up immediately.

In the bottom panel, bottom left panel, you see that Germans, on average, immediately went out, started consuming more. Instead, actually, on the right panel, you see the first two announcements of Mario Draghi, of unconventional fiscal -- unconventional monetary policy, in the

summer of 2013 and in January of 2014, and, at least, when you look at households' expectations and their purchases, those two announcements had no effect on the average German, but also in all different types of subpopulations we studied.

So, it looks like simplicity and complexity of policies matter for the effectiveness, and, then, of course, maybe, also, this means that we might have to think harder on how we want to actually communicate policies, so that actually everyone tends to actually behave as we would hope to.

Now, actually, to close the circle, and also a little bit -- end on a more benign or positive outlook, we actually want to go back to this initial paper with (inaudible) in which we actually, then, try to do an information experiment, or a so-called randomized control trial. So, what we do -- and think about, sort of, I, now, ask everyone here, in the room, what do you think is inflation over the next 12 months, and then just randomly group people into nine different subgroups, and then each subgroup, in a random fashion, gets a different piece of information, relevant for monetary policy, and, subsequent to this information provision, I ask everyone, again, what's his or her inflation expectations are, and I want to understand whether, in case you are able to talk to people directly, does it affect individuals expectations, and what you see here, in red, there's actually strong evidence that, if I tell people the Fed targets an inflation rate of two percent, you see this very strong reaction in inflation expectations.

So, it's, indeed, if you have a way of communication directly, with ordinary people in the U.S., people do react to it, but the second thing you also see now, in plurals, so often times, one argument is, you know, we have no press conferences, the media reports about our policy actions. So, therefore, there's maybe no need of direct communication, but I could indirectly rely on the news media to effectively convey my message. When we actually forced individuals to read a newspaper article about the most recent FOMC meeting, you see that, actually, the reaction, at least, in our sample, was only half as strong.

So, on the one hand, I think the bigger challenge is to get people to read newspapers, but, even once you actually force them to read, they seem to systematically discount information, and let me actually end on a -- maybe some of the conclusions of the paper. So, there is hope that, if you are able to directly communicate with individuals, they do react, but simple messages seem to be important, and one of messages might not be enough, but repeated communication. Thank you.



MS. LIANG: Okay, so. So, thank you for two terrific presentations. I thought I would start with a few questions to let these authors elaborate even a little bit more on what they've just said because there's a lot of richness behind what they've said. We'll do that for a few minutes, and then we will also take some audience questions, following that.

So, maybe, Silvana, if I get to start with you. You know, pretty compelling evidence that there is this underlying Phillips Curve, alive and well, once you control for the supply and demand shocks in your way, but we still have this puzzle of inflation's been below target in the United States for the last 10 years, and you willing to -- can you say something about whether it -- do you think it's more attributable to cost shocks, or demand shocks, or, you know, your model under -- assumes there's sort of a effective monetary policy, but we have this weakness in inflation over the last decade, and how would you try to parse out, if you could, from your model, or just your judgement?

MS. TENREYRO: Okay. So, one thing that we observe, right now, is that -- let me speak for the U.K. -

MS. LIANG: Mm-hmm.

MS. TENREYRO: -- that the Phillips Curve, in terms of wage growth and unemployment, wage inflation, is very evident and very healthy. We have very low unemployment as in the U.S., and the last reading of wage inflation has been four percent, in unrealized terms. So, that's a very healthy and alive Phillips Curve.

Now, the big puzzle is why this wage increase is not being passed through onto prices, so not as strongly as we would have expected, and, so, a couple of reasons. Obviously, wages are not the whole story. So, there are other inputs into production, and it's possible that some of them, like, you know, rental, commercial rents, are dragging down on inflation. Another possibility is that lower markups are absorbing part of the cost increase from wages. So, there's this wage -- wage increases are not being passed through to prices, right now, but it's a matter of time, and another possibility is that productivity growth has -- or is higher than what we are measuring currently, particularly in retail, and, so, the cost increase is not as high as we would increase.

So, I think we need to investigate all these channels, and, probably, the truth is, you know

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MS. LIANG: Yeah.

MS. TENREYRO: -- has a share of each of them. So, in terms of wage space, which is the direct connection with unemployment, we are seeing it, and I think, also, in the U.S. Though, it was lightly -- lower extent at -- in the U.K., and the question is, you know, when will this be passed through to prices. My own sense is that this is just a matter of time.

MS. LIANG: Just a matter of time. Okay. Thank you. So, turning to Michael. So, some compelling evidence about household formation of inflation expectations, and that households may not be that well informed, but can be sort of trained. So, can you talk a little bit about whether households -- does it matter if it's households or professional forecasters? I mean, inflation models are about firms, as price setters, but, in the U.S., we have households and we have market or professional forecasters. Does it matter? Is it sufficient for market participants to understand? Do you need households to --?

MR. WEBER: No.

MS. LIANG: -- have accurate inflation expectations of a policy to work?

MR. WEBER: So, I think you raise an important question. So, you know, at a basic level, the type of models we typically would write down, the consume -- have consumers consuming and savings. They have firms setting prices and hiring people. Typically, at least with the models that I write down, they don't have professional forecasters in there, and they also do not or rarely have financial markets in there.

So, ultimately, at least for through the lens of our model, what I would take away from that, to actually understand how effective policies are in stimulating aggregate demand, we ultimately do have to understand whether those people we model or hope to actually capture actually do react to that, those type of policies.

Now, of course, not only as you eluded to, unfortunately, in the U.S., at least up to now, we do not have a good survey of firm expectations, but -- so, we can actually go back a little to other countries, where we actually do have good evidence. So, for example, there's a very nice paper by (inaudible) who fielded their own survey in New Zealand, and what they actually found in New Zealand is that if you look at the expectations of firms, they are pretty much identical to the expectations of households. Instead, if you would compare the expectations of firms to the expectations of professional

forecasters, you see this big gap. So, therefore, to the extent we can extrapolate, it would tell me that, even in the U.S., most likely, I would expect firms to be way more similar to households, relative to the, maybe, well-anchored expectations of professional forecasters.

Now, to actually go to the second point of your question about financial market participants. So, one concern, there, was, of course, that what you measure with neutral expectations. So, a different way of saying it, they might be so-called polluted by -- with the measures of risk premia, and we know, of course, also since the work by Ben Bernanke and Kutner, that, actually, monetary policy can move around risk premia. So, it's always difficult, then, to infer for movements in financial market expectation that it's due to, indeed, the expectations component, or from the risk premium component, and, so, therefore, I think, you know, we can learn important things from financial markets, but I think, ultimately, we have to better understand households and firms.

MS. LIANG: Right. Interesting.

MS. TENREYRO: If I can add one more thing -

MS. LIANG: Of course.

MS. TENREYRO: -- I think it's very important who you ask in the firm because people who are in charge of pay reviews and pay increases, they do know what's CPI inflation or PCA inflation is.

MR. WEBER: So, my understanding from (inaudible) work is that, actually, they surveyed the C-Swede of firms, and, there, they found limited evidence, and, of course, you know, I'm with you that, at the end of the day, we have to also better understand who are the right people to ask, but there's evidence that, at least, some people that I think might be important for firm decisions, possibly have a less good information of overall inflation. They've already been informed about sectoral specific inflation. That's definitely also something we see in the data.

MS. LIANG: Mm-hmm. So, perhaps, could either -- both of you comment, or either of you comment, on how important -- so, forward guide -- going forward, forward guidance may be a really important tool for Central Bankers in the U.S., and maybe elsewhere. Given the research on sort of monetary policy effectiveness and inflation expectations, what do Central Banks need to do? So, to help make that more effective, and, in terms of forming expectations, Central Bank independence, all -- this is an open question. So, if you want to -

MR. WEBER: I think, actually, as Silvana eluded to during her presentation, I think Central Banks have been really successful in guiding expectations, and one way of seeing that is just measured monetary policy shocks. Let's say, from financial markets, Fed funds' futures are really small. So, they have been successful to manage expectations of one part of, let's say, the relevant players. For household and firms, maybe less, so, and, so, I guess, in this respect, we can maybe learn things from other Central Banks.

For example, one the one hand, we have, now, amazing initiatives. Let's say, the New York Fed Survey of Consumer Expectations, where they try to understand how individuals form expectations, the Cleveland Fed now following suit with a Center for Inflation. So, there are indeed initiatives of -- the Bank of England has done amazing work along those lines, but I think actually, maybe, we can even learn a bit more from more exotic type of Central Banks, or -- you know, on the one hand, we are working a lot with the Bank of Finland.

The most recent ECB decision was heavily commented on Twitter by Tuomas Valimaki, who was a Board Member of the Bank of Finland. He explained in plain Eng -- plain Finnish terms why the (laughing) what the Bank of Finland -- what the ECB did, and what it implies for the average Finns. On the one hand, I think this was really successful in trying to -- getting the average Finn on board, but actually, maybe, we have to even look at more exotic type of Central Banks.

I am not sure who is aware of what the Bank of Jamaica is doing. So, the Bank of Jamaica has this really successful initiative of anchoring inflation expectations, and how are they doing it? They actually recorded reggae songs with national reggae heroes singing and making music about price stability, why you want to have an inflation target, why you don't want to have too high inflation, why you do not want to have deflation, and what all of those things would mean. So, maybe, differently speaking, maybe reggae is not that popular in the U.S., but, of course, it is a case that maybe rap music is more popular, or it is the case that we have sports stars that are national heroes, and such. You know, this is now an observation of fun.

I asked my -- I don't even know the English -- hair cutter, at some point, whether she thinks, but her brother, who is maybe 20-21 years old, knows what the Federal Reserve is. She said no. Do you think he knows what price stability means? No. Do you think, actually, he cares about what

Lebron James says? Yes. So, do you think if Lebron James would rap about price stability he would listen? He said whatever he says he would care about. So, maybe, you know, this might be, now, a little bit far out, but this could be a, you know, as things we could learn from other Central Banks.

MS. LIANG: Oh, that's a lesson. Thank you.

MS. TENREYRO: So, I'd like to add two things. So, on -- so, let me tell you about the case of the U.K. We see huge dispersion in inflation expectations, depending on the segment of the population. So, the people who are farther away from the target, or actual inflation, are people with low income and low education. Now, it's possible that this segment of the population have little impact on the key allocative decisions because it, you know, their relative income is low.

However, there's a big, you know, challenge here, more broadly, to try to improve financial literacy in these groups of the population, so that they can improve their decision making. I think, in terms of quantitative income for the macroeconomy, probably, it will not be large. Is -- you know, that's -- so, that's the first thing, is, you know, we need to work on them. The Bank of Finland has, now, different layers of communications, trying to simplify the message for groups who have lower understanding of the economy, or economics.

In -- and I just wanted to add one thing. It's tricky with inflation. Coming from Argentina, everybody knows what inflation is, or, you know, it's something that people really -- it's very pressed in, and very important in their lives. So, people are constantly paying attention to that. So, one reason why, in the U.S. and other advanced economies, people have, you know, are less and less informed about it is that it's not that relevant for their day to day lives, but -- yeah.

MS. TENREYRO: Mm-hmm. That was a favorable takeaway from one of the -- from one of your results. So, I -- we can take some questions. If we could take a few -- we'll take a few at a time, and then -- Olivier? Could you state your name, maybe? I think I'm just looking for the rules.

MR. BLANCHARD: My name is Olivier Blanchard. I have to say great papers. I have many questions. I'll just ask one. To Silvana, I mean, the slope of the aggregate Phillips Curve has decreased over time. If your hypothesis is correct, the simultaneity hypothesis is correct, we should not see the same decrease from a state Phillips Curve. So, the question is what do we see when we actually look at the estimated slope of a state Phillips Curve over time?

MS. TENREYRO: Yeah. Unfortunately, we only have the data from the '90s onwards. So, I cannot answer that question, but -

MS. LIANG: Okay. Can we take a few -

MS. TENREYRO: You want to take a few? Yes.

MS. LIANG: If that's okay, yes, please. Can you state your name, please? Go ahead.

MR. SCHROEDER: Do I need a microphone? Yes.

FEMALE SPEAKER: Yeah, mic's fine.

MR. SCHROEDER: Robin Schroeder, with International Investor. I wonder if your survey actually tells us that people in this country, even the 40% who are the least knowledgeable, know more than some economists do, and to wit the biggest checks that the average family writes each month are for housing, healthcare and insurance, and higher education. I can show you chart after chart, that, over the last 10 years, they have all risen much more than two or three percent a year. So, are we measuring the wrong things when we really try to -- or, at least, underweighting these topics when we're looking at inflation?

MS. LIANG: Okay. Thank you. The question over there, and could you say your name and please stand? Thank you.

MR. BLANCHFLOWER: Hello. Danny Blanchflower. I just wanted to follow up Olivier's point, in a sense that, if we try to get to what's up with inflation, we probably need to know what's changed, and I think Olivier's point is right because if you estimate a wage equation, post 2008, the unemployment rate actually doesn't enter into a wage equation. My suspicion is following Olivier's point. It probably doesn't enter into this inflation equation either.

So, presumably, what we really need to see to understand the question is what's changed, rather than have a 1990 to 2017 equation, and there's also puzzles. You've mentioned the wage growth of the U.K. is four percent, and that's true, but it's also -- the CPI has just dipped below two, and it's now 1.7. So, we have to wonder about the relation between wage growth and inflation, but the two things, now, are going in opposite directions, but that I think they need to see the structural break.

MS. LIANG: Thank you. Do you want to start?

MS. TENREYRO: Can I start?

MS. LIANG: Mm-hmm.

MS. TENREYRO: Let me take Olivier's and Danny's at the same time. As you probably also know, what's dragging inflation in the U.K., at the moment, is energy prices. So, DGI inflation, Domestically Generated Inflation, is going up, in part for -- because of wage pressures, and the big drug is driven by this gospel shock, but, Olivier, so, coming back to your problem. We cannot do that, as I said in the regional level. What's interesting, and I think reserves, you know, further study is that the wage Phillips Curve, for the U.S., seems to be working very well, and that's the point, and, even over time, it hasn't flattened as much as the point that Matthew Longley has made in a very nice discussion. So, maybe more to see, it might be that the cost base has changed and, you know, in some sense, wages matter less for the CPI or PCE basket, but in terms -- in wage space, it seems to be working well, and the flattening is less clear.

MR. WEBER: Yes. So, you have raised many important points with your question. I think, you know, one way of thinking about it, I think the points you eluded to, those are price changes that are very salient, important for -- in daily life, and easy to measure. Instead, you know, if you think about an iPhone, let's say it had a price of \$999 for the last 15 years, even though an iPhone, today, it's a very different animal than an iPhone, like, 15 years ago.

So, official statistics take this into account and do a quality adjustment, which actually, of course, we now -- are maybe calculation of my personal inflation rate. I would not take into account. So, there are many, many subtleties, nothing -- maybe I'll bet -- we'll also talk a little bit later about some other things that actually enter exactly this discussion you were raising, and I think it's definitely important that people tend to think about these big ticket things in their daily lives that are important, but might ignore maybe other things that actually might trend down, like electronics, more generally.

MS. LIANG: Thank you. Microphone, please? Take the -- three more questions, and then if you could make them brief, please, so we have time. Please.

MR. DOYLE: Peter Doyle. One point and one question. On Jamaica, the videos that you refer to came out after inflation had been lowered. So, their particular role in what happened in Jamaica is probably contradicted, somewhat, by the data. My question about inflation undershooting for a long period of time, in the United States, to what extent do you think that's a possibility? The possible

explanation is that the Central Bankers, themselves, do not believe in two percent. They take to themselves the judgement that it would be better for the United States, and for others, to be below two, and, hence, that's what they deliver.

MS. LIANG: Okay. Thank you. Yes.

MR. BENOWITZ: Thank you. David Benowitz. I'd like to expand on a comment that was just made, and that is that is that lower income people do see higher rates of inflation because of this quality adjustment thing, and this could be a large part of why so-called lower IQ people see a higher -- have a higher expectation of inflation because you're seeing higher inflation, and does it really make sense to measure inflation the way it is now?

MS. LIANG: Okay. I have a question over here.

MS. RUTI: Thank you. Blarina Ruti, from Barclay's Capital. I noticed in your Phillips Curves regressions, especially Professor Silvana, that there was no control for a relative import price, and I was wondering what the thinking was, there, and then, for both of you, perhaps, to comment whether import prices have an issue -- play a role in the recent weakness in inflation. For example, in the data, we notice a distinction between core services and our core goods inflation in the U.S., both in CPI and PCE, for about two and a half decades. Core goods inflation has been almost zero. At the same time, this -- are the components of inflation that have a higher import penetration, are more globally competitive.

MS. LIANG: Thank you. Do you want to talk about the question?

MS. TENREYRO: Yep. Taking the first -- the last one. Obviously, CPI imports inflation - - sorry. Imports inflation are import -- is important. We control for past CPI inflation, as a way to capture those past pressures, but you could also add measures of -- input price inflation directly. It wouldn't change a lot, the slope, but I think that would be the right thing to do, if you have enough, you know, power to -- so capture those. We do control in the final one, for aggregate effects, which in principle should affect, you know, the whole country equally submitted. To some extent, some of these effects might be absorbed there.

I won't comment on the undershooting on the Fed, just to say that, you know, one possibility is that, you know, there's, you know, the economy could or, you know, the monetary policy could be potentially more expansionary, and it depends, again, on how much weight is put on achieving



the target or not. So, let me just stop there.

MR. WEBER: So, maybe it's just a quick remark on Finland. So, I guess, from the perspective of the U.S., we might actually call Finland a socialist country, which means that, actually, there's not a strong correlation between IQ and income. So, in microdata, the correlation is about 0.15. So, I think that's a nice testing ground because it allows you to disentangle effective cognitive abilities from affects of income, education that is free, everyone can go to college, and, so, therefore, actually, I am pretty confident that I can, actually, at least, in that specific setting, disentangle the effect of cognitive abilities from things you have raised.

MS. LIANG: Interesting. Okay. On that, I think I'll -- I mean, thank our panelists.

MS. SHEINER: Okay we're going to move right into our second panel and the second panel is about it's all about technology and globalization. And we are very pleased to have two really wonderful presentations. The first is by Kristin Forbes who will talk about globalization. And Kristin is the Professor of Management and Global Economics at the Sloan School at MIT. And she was from 2014 to 2017 an external member of the Monetary Policy Committee for the Bank of England. And our second presentation will be about technology. And we have a presentation by Alberto Cavallo who is Associate Professor at Harvard Business School and also the founder of the Billion Prices project which he will tell us more about. Kristin.

MS. FORBES: Okay I have been asked to answer the question, if it's all about globalization. And there's a lot of reasons why you might think it is. A lot of reason why changes in the global economy would be affected to affect inflation including in advanced economies. For example, take increased imports from low wage economies, that would be one off reduction in prices and inflation. Take just increased more generally. Increased trade integration would mechanically mean a higher share of price indices are imported. And therefore, prices would be more related to changes in global demand and supply.

Or take the fact that emerging markets now have a greater heft in the global economy. So, shifts in demanding emerging markets, increasingly drive shifts in commodity prices. It's driven larger movements in commodity prices and oil prices over the last decade and that increase volatility and commodity prices and energy prices could feed through into prices in advanced economies. Especially if

effects are non-linear which there is some evidence of.

And then, there is also whole literature arguing that increased global supply chains. The ease of just shifting small parts of a production process to where it can be done most cheaply would affect pricing decisions by companies. It will affect how exchange rates interact with pricing decisions by companies. And it could also reduce worker bargaining power within countries because it's much easier to shift small parts of production elsewhere where it can be done more cheaply.

So, lots of reason why globalization might affect inflation. Whether it's one offish affects or affect the whole inflation process or affect the Phillips curve relationship between domestic slack in prices. And if it does, there's some pretty important implications for central banks and Janet Yellen mentioned in her introduction.

So, not surprisingly, there's been a few people working on if globalization has affected inflation, here's just a couple of papers. For my comments, I'm going to draw on some research I've been working on for a couple of years that I presented actually right here at Brookings a few weeks ago. But where the literature is moving is that globalization is important. Some of what is going on with inflation, dynamics does reflect globalization but it's definitely not the whole story. Some of the other factors we're going to talk about here today are also important. And the answer is also more nuanced than I initially had thought when I started working on this.

Yes, globalization does seem increasingly important when understanding the dynamics of CPI inflation, headline inflation. Globalization is increasingly important in understanding the cyclical short term ups and downs in inflation around the world. But globalization has had less important a role in explaining some of the recent patterns in core inflation and wage inflation. That's not to say it's not important. Globalization, some global factors are still important more so for core inflation, only moderately so for wage inflation. But the real change in their impact has been on CPI inflation and headline inflation with just more moderate effects for wage and core inflation.

And in the Brookings paper I did on this, these results are supported by coming to these questions through some very different approaches, different inflation measures, different techniques, different countries. And what I'm going to do today is just give a couple of the key results which all sort of support the same story.

So, let me start with principle components. What I do here is I have inflation data for about 35 advanced economies around the world and I take out the shared principle component of these different inflation measures. Basically, how much inflation rates move together in these advanced economies around the world. And what you see is not surprisingly produce a price inflation. The brown line at the top is pretty correlated around the world. Producer prices, high traded components, so not surprisingly those prices move together in different countries.

The interesting patterns are the lines. CPI inflation now moves together much more tightly in countries around the world than in the past. So, CPI inflation could be driven more by global factors around the world. But wage in core inflation, the purple and blue lines, still seem to largely move by their own beat in different countries around the world. There doesn't seem to be as big a global component, shared of component driving wage and core inflation as you have increasingly seen for CPI inflation.

So, there's a lot of reasons this could be happening. This sort of just patterns in the data doesn't tell you what's going on. So, let's go a little deeper and I'm going to show you some results from a Phillips curve analysis. With all the caveats, this is certainly problems with this framework. I wasn't sure what I'd find when I started. But actually, when you do the Phillips curve for a cross section of countries, you find some pretty strong, pretty robust results.

So, what I'm going to do is first estimate the standard sort of work horse Phillips curve model that central banks, economists look at for large economies such as the U.S. Estimate inflation is a function of inflation expectations, lagged inflation and domestic slack. And I'm going to measure domestic slack using a broad measure not just unemployment. Then I'm going to do a simple augmentation of that model where you also control for import prices. It's a way to just control with one variable for everything else going on in the world. And those are the sort of standard workhorse models that really focus on domestic drivers and inflation.

Then I'm going to do an augmented model where I control for several different way's globalization could affect inflation. Changes in oil prices, changes in commodity ex-energy prices, changes in the exchanges rates, changes in global slack not just domestic slack and changes in the use of global value chains.

And then I'll do one more augmentation of that where it also allowed global variables to not just to one-off shock effects on inflation but also to affect this Phillips curve relationship between slack and inflation. So, basically can a country's exposure to imports explain the flattening of the Phillips curve that we talked about today.

So, when I estimate those models for CPI inflation, I find the simple domestic Phillips curve actually the variables all come in significant, pretty robust expected signs. Higher inflation expectations, higher lagged inflation, less domestic slack all correlated with higher inflation in a cross section of countries.

So, at least cross section of countries, this sort of frame work works pretty well. High import prices also correlated generally with higher inflation. But where it gets more interesting is then when you control for the global variables. Those also all come in significant with the expected signs. So, higher oil prices, higher commodity prices, ex-energy, exchange rate depreciations, less world slack and less use of global value chains is also all significantly correlated with higher inflation. So, that suggests these global variables matter, at least in explaining CPI inflation.

And in one more variant, when I also allow for exposure to trade or imports to affect the flattening of the Phillips curve which also comes through in this. This explains this is significant also and it looks like it's quite important. So, to give you some concrete example, if you look at the Phillips curve over the last decade relative to before the crisis, the Phillips curve has flattened as we've seen in a lot of other work. But import exposure explains over half of the flattening of the Phillips curve. So, that shows globalization not only is direct immediate affects on inflation but does affect this Phillips curve relationship with slack.

So, those are the effects for CPI inflation. So, we all know what though, in economics, if something is significant, it still may not be that important in magnitude. So, to get a sense of how important, including these global variables are to understand inflation, I also ran these models with rolling regressions and then calculated the errors. What if you estimate just a domestic model explaining inflation or add these different variables? How much does that improve our ability to understand inflation.

What you want is smaller errors. So, the lower these numbers, the better the model works. And what this shows is the black lines are the errors when you estimate the models with just

domestic variables. The red is when you include the global variables. So, it shows that including global variables does meaningfully reduce the errors. It reduces the errors of just this simple model estimating CPI inflation by over 12 percent on average. Particularly big reductions in errors around the global financial crisis. We're incorporating what's going on in the rest of the world as very important to understanding with CPI inflation.

But also, very important during this window from about 2012 to 2015, world slack plays a role in commodity prices in explaining why our inflation models didn't do so well. If you add the global variables in the inflation models, you can again, reduce the errors and improve the fit but about 12 percent. So, not the whole explanation, the models are still far from perfect, there's still other things going on but it does make a difference.

If you go back and do the same analyses though for core inflation or wage inflation, you find the basic model still largely works, domestic variables are still important in explaining inflation. Global variables are sometimes important. Exchange rates, commodity prices often important in explaining core inflation but less robust, magnitudes are smaller and much less important to the global variables in explaining wage inflation.

Also, there's some flattening of the Phillips curve when you estimate this for core inflation. Not as much in wage inflation and the flattening seems to be less related to increased trade exposure and increased in forward exposure for core and wage inflation.

And then if you also estimate the model and see how much does adding these global variables reduce errors in models to explain core inflation on the left and wage inflation on the right, you find it improves the models a little bit but not nearly as much as when you try to estimate CPI inflation. So, global variables meaningfully reduce errors in models of CPI inflation, only moderately reduce errors in models of core wage inflation. So, still helps to add them but you're not going to explain any apparent puzzles over the last decade.

So, I could stop there and when I presented this paper here a few weeks ago, that's largely where I stopped. But then Ben Bernanke asked me a very good question. Okay, so global variables matter for CPI inflation but which ones, by how much and did they really matter that much for the U.S. basically. So, I have an answer for your question now so you won't ask me in five minutes.

So, what I did is I took these models and I estimated, used the estimated coefficients, plugged in the actual variables for the U.S. and then estimated how big an impact these global variables had on CPI inflation for the U.S. And this is what you find. Let's start with some of the puzzles we've been talking about today.

So, during the period of sort of immediately during and after the global financial crisis, U.S. inflation was higher than many people had expected. What drove up U.S. inflation during that period? You see at least from sort of 2010 on, the exchange rate propped up inflation by a bit, about .1. Oil prices and commodity prices though were important in this sort of 2009, 2010, 2011 in boosting up inflation during that period. Global value chains by contracting weren't dragging down on inflation as much as before.

So, that's a part of the explanation for why inflation was a bit stronger during the crisis. But where I think the biggest results come in is the period sort of after the crisis, the 2010, 2015 window when inflation was slower to recover in the U.S. than some of our models predicted. So, how much of that was global variables.

So, what this suggests, the dollar exchange rate on the top left was part of the story that dragged down inflation a little bit, you know, .1, .15, .2. Oil prices, commodity prices also were a temporary drag. But I think the most interesting what really hasn't received as much attention is the bottom left. Global value chains as they picked trade, started to pick up more quickly 2010, 2011, 2012 its emerging markets recovering more quickly. That acted as an important drag on inflation during that window. And then global slack also acted as a drag on inflation.

Each of those affects by themselves are pretty small, you're talking, you know, .1's or .2's but if you add them all up, that does start to add up. And in comparison, the drag from domestic slack, there still was some because again, I have a broader measure of domestic slack than just unemployment. But as the drag from domestic slack on inflation faded, you still had some pretty meaningful drags from global value chains and from global slack.

So, that's what can explain some of the puzzle, again, not the whole story. But then the obvious question is so what's that mean for now. So, my sample ends at the start of 2018 but what it suggests is at least from 2018 forward, a lot of these drags that were holding down inflation in presenting

some of this puzzle aren't as potent anymore. Exchange rates affects are minimal, yeah, I'm not even going to try to predict what's going to happen to oil and commodity prices there.

But at least world slack which had been dragging on inflation in a meaningful way isn't dragging as much in global value chains especially as trade tensions are flaring up and companies are reducing their reliance on this sort of network of global supply chains. That could be an important factor no longer keeping inflation down which hasn't been fully incorporated in most of our standard models.

So, to tie up, I also have a whole set of results using a very different approach to modeling inflation out of the Phillips curve framework breaking inflation into a trend in cycle. And you get very similar results to what I just showed you today which, at least, increases my confidence in this set of results. But to summarize, where they all point is that globalization is increasingly important for understanding CPI inflation in the cyclical short-term movements in inflation. Wage core in the underlying trend inflation that were still largely a domestic process.

Globalization matters a bit. It helps the models a bit but it is really not the big explanation for any puzzles out there. And in terms of which global affects matter for CPI inflation, import exposure is important. It does explain a good part of the flattening of the Phillips curve for CPI inflation. And the other effects of globalization really do vary based on what period you're looking at and what the time window is. The global variables do seem to be important as a whole but there is specific importance in any specific window depends on what variables and channels you're looking at. Thank you.

MR. CAVALLO: Thank you. Thank you for the organizers for inviting me here. So, I'm going to -- I tried to mimic Kristin's title and just change the word at the end. And I decided to put Amazon because I noted these days if you just put Amazon in the title of a paper, a lot of people pay attention. But you can more seriously think of this as online competition, about technology, online competition, something happening in the market that is affecting pricing.

And as you probably remember, the story of the Amazon affect became quite interesting, particularly around the time where we were seeing low inflation two years ago that seemed quite bustling. And the argument was that Amazon is somehow putting pressure on the margins of some of these retailers and constraining their ability to increase prices, even in the face of rising demand.

And gradually, there's been increasing interest in the topic of online competition. I

personally, I should have mentioned this. I do a lot of work with online prices because about 10 years ago, we decided to start collecting a massive amount of data from retailers that sell online through the medium prices project. It's an academic project we have at MIT and Harvard. And in a sense, our data set should be exactly what you need to detect if online competition with Amazon is really affecting the behavior that large companies that are in the middle of this offline and online world.

So, I decided to try to tackle this question. There are others, I should mention, that have done related research, Gorodnichenko has worked a lot on the characteristics of online only type of pricing and he has detected a tremendous amount of flexibility in prices online. Then we have other papers that are focused more on the measurement side and what this internet pricing does to the way we calculate pricing. That's the Goolsbee and Klenow paper.

I tried to tackle this more as is there an Amazon affect and what is really the important Amazon affect that we should be focusing on in terms of inflation dynamics. And just to give you a preview of my answer, the story about the shrinking margin, I think, may be relevant. The truth is, I cannot observe those margins, these companies will not give us that information. But you can think of these essentially as if it is putting some pressure, it is a temporary pressure.

There is so much that margins can actually fall and eventually, when those margins are very, very small, you would have to see some reaction, quite quick reaction to some of these changes. I think if you want to take out something, I would think technology or online competition is affecting inflation then I think it's far more important for us to focus on the way pricing behaviors of these companies have changed over the years. And since we have ten years of data, we can follow that over time.

And there's one thing that we have detected or I should say two trends that we have detected as being particularly relevant for the case of monetary policy. One is that the frequency of price adjustment has actually increased dramatically. In part, I think this is because of pricing algorithms and the ability also to monitor what the others are doing in trying to mimic their behavior.

And the second one is about uniformity in pricing across the U.S. Many of these online retailers have a single price, people have come to expect that they're going to get the goods quickly in just a matter of days for free in theory in terms of shipping and there shouldn't be any difference in how in the prices that they they observe if they're in Boston or San Francisco. And that is sort of making these



companies price identically all over the U.S.

So, you put those things together, what does that mean for inflation. I argue in this paper that it's basically making these prices more reactive, more sensitive to, I call them here, aggregate shocks. But you can think of them as national type of shocks. This is less about the local type of idiosyncratic levels of (inaudible) for example and more about what's happening on our national level. Which can be related to decreasing sort of domestic type of national shock or you can think of it as a global shock.

And I'm going to show you, in particular, to argue that some of the slow down that we had in 2017-18, was actually related to the costs type of shocks in gas prices and the exchange rate. But that has actually changed recently and they're more inflationary now. So, let me walk you through the results and document these facts.

First, there is a tremendous amount of algorithmic pricing at least in theory. Again, companies are not very straightforward about how this is happening. But since 2013-14, we've been hearing stories of these companies using algorithms to make pricing decisions. It sort of make sense, we're letting our, you know, algorithms drive our cars, why wouldn't we allow them to make our pricing decisions. And certainly, these companies have a tremendous amount of data.

It doesn't really matter if it's just one company or all the companies doing it. A (inaudible) characteristic is that many of these companies are monitoring each other constantly and the cost of doing that has decreased dramatically. So, if there is someone using these algorithms, others are replicating the same behavior and you get the sort of pricing patterns affecting everyone more or less the same.

What I'm showing you here is basically how the duration, the (inaudible) how long prices tend to stay constant has shifted dramatically across all categories of goods. Particularly in goods where you would expect online competition or competition with Amazon to have increased particularly in recent years. You can see, for example, furnishing and household goods falling from about 14 months to just 6 months in our data. And I'm keeping constant (inaudible), the retailers, so we know it's not about the competition. And in sectors with Amazon, at least until I finish the sample, does not seem to have much of an impact. You can see, it's relatively stable. That may change in the next few years. So, there's this tremendous amount of flexibility.

The second point I want to make and has increased over time. In the paper, I also try to link it specifically to goods that compete more with Amazon and you do observe for those goods, have particularly more flexibility. The second thing has to do with this uniformity of pricing which is a little bit bustling. Because if they're using algorithms to change our prices over time, why are they not using them to sort of give us very different prices at the same time.

And here, the thing that gets complicated is not a technological constraint that they face. I believe they face the fact that online pricing has also made it tremendously transparent. You can see prices in different locations and people have concerns if they see they're getting charged a different price for exactly the same good in a different location.

There is this fairness concern. If you talk to these retailers, they will tell you, we are very worried about using these algorithms to customize prices because we will break the trust of our consumers. There's an old story, by the way, Amazon faced some criticism in 2002 for allegedly trying to price discriminate and sell CD's at different prices to different people at the same time. And they promised never to engage in pricing based on demographics again at that time.

So, technologically, they can but in terms of transparency and fairness concerns, I think we're actually seeing the opposite, there is this uniformity. And what I'm showing you here is we did this sample where we collected data online and offline for 102 zip codes, 10,000 goods. We caught them roughly at the same time. And what you can see is that they share identical prices across zip codes for the same goods is nearly perfect. It's higher in Amazon than in more traditional retailers but more traditional retailers are not that far behind.

So, why does this matter? You put the two things together and as I mentioned in the beginning, high flexibility in these sort of national pricing policies, you would expect the prices to be reacting more to these sort of national cost shocks. And that's what I'm showing you here. In fact, you can take gas prices and exchange rates which are producing shocks so we can monitor.

And you see that goods that are in direct competition with Amazon, in particular here, I'm taking Walmart's prices. They tend to change prices more often. They tend to be more uniformly priced and, by the way, they tend to have a higher pass through rate for gas prices, for exchange rates as well. And the papers sort of shows that the sensitivity to shocks is actually increased in our sample during time as well.

You may be thinking at this point, well this is exactly the opposite of what we expected to explain the bustle. You know, they're adjusting faster to these shocks so why aren't we seeing something. Well, I think it's this is sort of pointing us in the direction of trying to identify what are the shocks that we have experienced in the last few years. And in that sense, what I did here is try to show you how first, with online prices in particular, you can actually find that the volatility or the movements in gas prices and exchange rates actually explain a lot of even the core prices that we can compute.

So, while you're looking at that, just focus on the orange line for a second. That's like an online core equivalent to the realist core but we computed with the online data we get from these retailers. That are arguably far more exposed to the Amazon competition than you would get in a CPI sample that has these retailers and others.

And historically, basically this time period where the bustle was greatest and if you look at it in the timing, basically until January 2017 when the annual inflation rate in online prices was falling, was a time when gas prices were falling and the dollar was appreciating. It started to turn exactly at the point where gas prices rose in January 2017 and the dollar started to depreciate and it depreciated for roughly one year.

Since then, you can think of these two forces of sort of balancing each other. We have an appreciation in the dollar, you have relatively high gas prices but the ups and downs that you see in this orange line are actually quite closely co-moving with gas prices. The CPI sort of sense shows you the same message, it's only shifted. It has a lag which complicates the identification of this type of effects of these cost shocks.

So, just to finalize because I'm out of time, my view is even core prices today due to these technological changes, these changes in pricing behaviors is becoming less insulated from these shocks. So, my argument is we should sort of be paying attention from them and it can go both ways. It can be more deflationary but also if some of the shocks are to pick up, we should be able to see more inflation in the short run.

Now, if the focus is going to be in understanding these shocks, we need to think more carefully about what drives, what sort of variables actually affect these pricing algorithms and how the shocks are perceived by customers. I'm doing some research now on the trade war. When I started

doing this, I expected the pass through to be quite high. And what we noticed is that at the retail level, there's some limitation because of the way many retailers perceive how temporary this shock was going to be or how it was going to be for them to wait a little longer before implementing those shocks. So, in any case, and I have a last point I will mention but I'm way out of time. So, thank you very much, I'm happy to talk about that later. Thank you.

MS. SHEINER: Thank you both for a really fascinating and incredibly clear presentations. I want to start with a clarification question for you Kristin. Not really clarification but kind of an interpretation. So, your finding is basically that globalization is sort of important for explaining headline CPI and even the flattening of the Phillips curve which is really interesting but not for core and not for wages.

So, one of the mechanisms I thought that where it might flatten would be, you know, there's no, you can't ask for wage increases because you've got foreign competition. So, how do you -- like what is the economic story that explains that distinction? I mean, I know you don't know it from the data but what do you think?

MS. FORBES: So, let me first clarify. So, I still find some role for the global variables for core and wage inflation, so it's not saying it doesn't matter at all. For example, when you put them in the models, they reduce errors by sort of 3 to 8 percent or something but not like 12 to 15 percent.

MS. SHEINER: What about flattening?

MS. FORBES: Flattening it sort of might explain about 10 percent if I remember from one of those sort of baseline estimates, 10 percent of the flattening. So, it's there but it's not nearly as strong as for the CPI. So, I think there is a puzzle there. I think some of it could just be that we have had these huge sums of movements in commodity prices, oil prices which are seen as short term. So, central banks, back to our first panel, central banks may not respond to those because inflation expectations are well anchored. So, you don't get the reactions there.

I think just also something going on, what also came up in the first panel, is there is this puzzle where there has been -- the wage Phillips curve is working pretty well. You don't see the same flattening in that and you haven't seen the same effects of globalization. Wages are now going up in some countries but prices are not. So, that does suggest there's something, as Silvana said, something

going on with productivity growth may be increasing more than we know. I don't know about that, or firms are reducing their margins and that's something that they could do for a period.

There were some excess profits in there that could be shrinking but that can't go on forever. And if that's part of the story, then we might see some of these effects come through later on. It may be a temporary affect.

MS. SHEINER: So, that kind of brings into this sort of, you know, what's up with inflation. So, how much do globalization and technology explain it and to the extent they do explain it, you know, is it because things have been happening that has sort of masked this underlying Phillips curve as in the first panel. Or because they fundamentally changed the structure of the inflation process and of the relationship between (inaudible) gaps and inflation. And I want to get both of your views on that for globalization and why don't we start with technology.

MR. CAVALLO: Sure. So, I think I'm more in the camp that it is masking the relationship. And it's basically because I believe, I do notice that prices are quite reactive to some of these shocks. It's just a matter of identifying what those shocks really. And we may be placing too much emphasis on the very short run of what is happening with the U.S. which is understandable.

But I think we need to acknowledge that if we carefully try to understand the characteristics that each shock generates at the retail level, we're likely to understand better some of the recently placed dynamics. So, I'm more in the camp of seeing this as a relationship that is there, it's just that we are not considering the right type of shocks to see it.

MS. SHEINER: And the story that would say, but well people don't have pricing power so they can't react, right, because now it's so easy to price compare. Is that not -- and so, maybe that would change the slope, you don't think that's --

MR. CAVALLO: No, I think that's a concern, particularly in the short run. But then you can think how low can margins fall and how sustainable it is which is what Kristin is saying. So, I did briefly mention, for example, that when we're looking at the effects of the trade war and what we do find is you can think of this additional shock being eventually passed onto consumers. But there are some stages where in the data actually this can stop it and one would be if the exporters from China were to drop their prices. We do not find that. We find that importers today are paying a significant cost of the

tariffs. So, there's food passthrough at the border.

But then that doesn't necessarily assume that we should observe a very quick passthrough at the consumer level. It depends on how these retailers are internalizing that cost and how long they think they can sustain their reactionary margins. The areas that we have currently in our research suggests that they are reducing some of these margins but I question just how long that can be maintained. And, I think, as soon as those margins are low enough or they can become convinced that the shock is permanent enough, we're going to see a very quick passthrough into consumer prices.

MS. SHEINER: And if I ask you to explain sort of the puzzle that we started with, you know, not enough deflation, you know, during the great recession, not enough inflation now. And I said, so how much of the Amazon type affect can explain it and not just the particular years that you pointed but like is that an important part, not an important part, do you have a sense?

MR. CAVALLO: Well, I think, Kristin's analysis was far more long type of analysis, no, and in terms of that graph. I am mostly focused on the last four or five years. And I can tell you from that perspective, in knowing that some of these pricing competitions is actually making prices quite reactive to these shocks. I can only explain or argue that there is not much of a passthrough going on with inflation when you take that into account.

Now, usually we at least in (inaudible) and I suspect it also happens at the Fed. We tend to have this impression that the passthrough rates from some of these shocks into retail prices is relatively low. So, we just remove them and we focus on core, we shouldn't be looking so closely at them. The point I'm making is, I think, we should increasingly be more focused and making the connection to commodity prices and other sort of type of cost shocks.

MS. SHEINER: Great.

MS. FORBES: So, actually before I answer your question, one just common area is to, I think, there are two results there's a nice complementarity. Where one part of my analysis that I didn't get into in much detail is you find these bigger movements in commodity prices over the last decade. So, that is a direct affect on CPI inflation and you see it in your results.

But what I also find is the sensitivity of prices to commodity price movements is increased which it also fits with your story. And it might -- how I justified that before seeing your paper, was that

there could be nominators. There's some nice work by Hamilton and others that shows, you know, larger movements in oil prices lead to larger adjustments by companies. And that fits with many price costs models. You know, bigger shocks, you adjust prices faster. And again, it also then would be accelerated by the affects you're getting so it's a nice link between the papers.

But back to your initial question of so does globalization need just sort of one off affects in the level of inflation or the inflation process. And what I find for CPI inflation is both. The global variables have had some big one off affects, short term affects on the level of inflation. Some could continue depending on what happens with global value chains, et cetera. But it also seems to have affected the process by which slack feeds through into inflation, for CPI inflation.

Core inflation, you still get some direct level affects, especially commodity prices global slack have hit some more role. A smaller effect on the Phillips curve and then wage inflation smaller still of both the direct level affects as well as the channels do slack.

MS. SHEINER: So, we sort of talked about how much we can explain of what's happened with inflation. Now going forward like in advice for monetary policy in the central bank how does thinking about including these affects matter. So, for example, these more frequent prices changes, does that mean they should be focusing on a different measure of inflation, does it mean that inflation will be moving around a bit more. Like is there an implication for monetary policy just of this structural change in the economy and similar for globalization.

MR. CAVALLO: So, in terms of what to look at, I think for my reasons it's important to incorporate the exchange rate and gas prices. You can also think of relating it to the discussants of inflation expectations. That's also why the Fed may want to pay more attention also to headline than to core.

But I also wanted to make the argument that a measurement can actually be changing because of this. We have statistical methodologies that are based on a very different type of environment. And as you can think of, the frequency of pricing is increasing but in particular also the rotation of products changing. We should be thinking about whether we're measuring well in some of these inflations of these things. And it's something that's often, I think, overlooked. We tend to think inflation is better measured than other statistics. But you can expect it to be playing a role as well.

MS. FORBES: So, I think my answer to that is pretty straightforward. I would like to see, especially in academics, there's still tendency for academics who focus on inflation in the U.S. to just write a Phillips curve and ignores the rest of the world. Just a domestic slack, inflation expectations, lagged inflation and you're done. Maybe oil prices.

So, I would like to see at least academics doing these sort of simpler models include more terms to incorporate what's going on in the rest of the world, it can matter. Central banks do with their more complicated DSG models, do incorporate the rest of the world some. There are probably ways they could evolve that and put more weight on it.

But what I also came from all the work I've done suggests that the affect of the global variables does vary over time. So, you also do need to allow flexibility in these models where sometimes some of these affects seem to modeling, they seem to grow at certain periods, be less important than other periods. So, you have to have that flexibility built in.

MS. SHEINER: All right, so I'm going to open it up to the audience for questions. Again, we're going to take like three questions at a time. Raise your hand, a mic will come to you and state your name and where you're from. Any questions? Way in the back there.

MR. REDMAN: Hi, Michael Redman, SPX Capital. And I hear kind of conflicting stories on both these issues. So, sometimes you hear that we have increasingly comfortable monopolistic companies who don't have much competition. Other times you hear that Amazon and other forces are really pushing their margins and forcing them to pass through prices quickly.

And then with globalization, you know, even before Trump, there's a lot of handering about kind of the slackening of globalization that the hyper globalization era had already ended. If you look at like import of intermediate goods, you know, that really flattened out already before kind of at the financial crisis period. So, how do you kind of square these competing stories that you see from a lot of economists on what that means for inflation?

MR. BECKWORTH: David Beckworth. And this is maybe more for Kristin. But on the globalization front, you know, I know we're thinking about the U.S. here, the low inflation in the U.S. But if you look around the world in all the advanced economies, Japan, Europe, we have this struggle. It's also where we see low real interest rates.



At Jackson Hole, you had this incredible graph that showed the real rate in the advanced economies going down and emerging markets it was high and robust. And we're also the parts of the world that provide the safe assets. So, I'm wondering if there's a safe asset story here, the demand for safe assets being provided by the advanced economies. Kind of a global, you know, money demand liquidity shock that feeds into the low inflation in advanced economies.

MS. SHEINER: Why don't you take those two.

MS. FORBES: Okay let me start with the first one with sort of different stories about globalization. Has it increased, has it decreased, especially trade integration, global supply chains. When I started on this, I thought global supply chains, that's an easy concept, it's very hard to measure what you mean by that. There's very different -- it's not just increased, because increased trade seems to correlate with GDP growth. So, really flushing out how much global supply chains are increasing.

I finally found some measures which not only get at how much trade there is in intermediate goods but how much of that is complex in terms of crossing borders multiple times, just not one time. So, the measure I use in this paper is a principle component of a number of different components get together what at least in my head I think of is global supply chains.

And when you do that, what you see is a pattern, global supply chains increased as you'd expect pretty quickly pre, before the global financial crisis, collapsed during the global financial crisis, came back pretty quickly and are now at pretty high levels, stayed pretty high and have started to decline a bit recently. And I don't have data for the last year, my guess is they would have declined even more the last year.

So, that's how you can get some different affects of these global supply chains and globalization over time. Contributed to higher inflation in the period right after the crisis is this mode of producing things more cheaply collapsed. But then it came back faster than growth in some advanced economies and contributed to lower inflation 2012 to 2016, 2017 and now we're having a diminishing impact going forward. So, that's the time series, I think, that gets at your question.

The question about safe asset story, low integral interest rates, I think that's all probably interrelated to some of this. One of the key points that I tried to politely make at this Jackson Hole discussion you referred to though was I think we put far too much weight on these estimates of this

neutral interest rate. It's so hard to get at. The margins error are massive depending on how you estimate them.

So, I think the concept makes sense but we're really wringing our hands over getting these exact estimates when you just can't. But where I think the safe assets story probably does play more role than sometimes gets attention is when you do get some of these shocks. You do get movements in and out of certain currencies which have the safe asset. And that does drive exchange rate affects which do seem to be more important than, I think, many people take into account in terms of what's happening to inflation. Especially as trade has increased, global supply chains, these exchange rate movements can have some pretty big affects on pricing.

And in the U.S., people tend to say it doesn't matter much. It certainly doesn't matter as much in the U.S. as other countries but at least my estimates suggest it is there. It does help on the margin explain some of these puzzles when inflation has been a little high or a little lower. So, I'd like to see more attention more through that channel, maybe less focused on exactly estimating this neutral large start.

MR. CAVALLO: Yeah, and I completely agree with this last statement. And maybe because I'm from Argentina so everything that I see with prices to my mind has to do with exchange rates. But I think my results are suggesting there's more path for them than we typically assume.

I want to say something, you said, it's true that there are sometimes conflicting stories about the margins. For example, Amazon shrinking margins where it's becoming someone who will have huge margins and therefore lower pricing. That's why I was trying to distinguish between the more traditional Amazon affect which is this shrinking margin story. I think that's a short term story.

Twenty years ago, people were talking about the affect of Walmart then how imports from China were creating a Walmart affect. It can be useful to explain some sort of short term deviations and I'm not arguing it's not but I see it as a temporary affect. Now in terms of how Amazon and their competition is changing the way pricing decisions are made, I think that's going to be important whether we're in a more, you know, deflationary environment or some of these costs to pick up. And that's why I believe that's where we should focus our emphasis on the impact of technology and its implications from monetary policy.

MS. SHEINER: All right.

SPEAKER: (off mic) results. And then a comment, I mean, Amazon is not just a monopoly it's also a (inaudible) when it buys goods or maybe those are the margins that are shrinking and that explains it.

MR. PULZER: Yeah, Carl Pulzer, Center on Capital and Social Equity. If we had this conversation when the Phillips curve was originated and the monetary system was developed, there'd be a lot of talk about labor and its bargaining power. Like headlines could affect the expectation of inflation and, you know, if it could shut down the steel industry. We really don't see that anymore and now you see if you go to McDonald's and you talk to people about should you get a minimum wage increase that's significant. They said well, then our hamburgers are going to cost more. So, are we saying, in other words, the flatness of the curve is a lot of it because labor is now more of an independent variable or more of a dependent variable and not independent actor? Is that a question, I guess?

MR. CAVALLO: So, just to answer what was asked. It's actually quite very consistent with the paper by Penelope Goldberg. There are other papers that have documented that at the border, there's food passthrough. So, it's not the case that the Chinese exporters have significantly dropped their prices or the burdens on the U.S.

Now, there's a question of whether that is being passed onto consumers and that's what our paper sort of adds to the picture. We find exactly the same at the border but we find relatively (inaudible) passthrough. And that's why I was trying to make an emphasis that we have to think about the shocks and sort of incentives it generates. The transmission of that shock is going to be very different from a shock like gas prices which can feed directly into these pricing algorithms and very quickly be observed at the consumer retail level.

MS. FORBES: In response to your question about labor markets, I think there are a lot of very interesting things going on. When I was working at the Bank of England and talked to companies around the UK, I was always amazed at how many companies would say, we can't find enough workers, we can't keep workers. And I'd say, well just pay them more and they'd say no, we can't, because then our prices will be too high and we can't compete.

So, you've heard stories like that again and again. And I think there's a very interesting

dynamic going on. Some of it is globalization, increased competition with goods from other countries. But also, a lot of interesting things going on domestically. More workers are going, are self-employed or part of the sharing economy, working for an Uber, working part time.

So, in the analysis I did, I was very careful not to just look at the unemployment rate as a measure of slack. I also brought in things like hours worked relative to normal hours. Share of workers who are self-employed, some of whom may not want to be although some may choose that. Share of workers who are part time, people who dropped out of the labor force, things like that. And I found in my results that having that broader measure actually significantly improved the fit of the Phillips curve. So, those other dimensions in the labor market are very important.

But the reason I didn't talk about that much and I assume we haven't much is we have a nice panel on this and they're going to focus on that. So, hopefully that will also get at your questions in much more detail.

MS. SHEINER: All right, we're out of time. Please join me in thanking this very interesting panel.

(Recess)

MS. AARONSON: Hello, welcome back. We're going to get started on the rest of the event. So I'm very excited to introduce our next panel, it's all about the labor market.

We have two great panelists. The first is we're going to hear from Katia Peneva. She's a principal economist in the Prices and Wages section on the Division of Research and Statistics at the Federal Reserve Board. And just to provide some context, that's the section that's responsible for preparing the forecast of inflation in wages and prices for the FOMC. I have to admit that Katia and I were longtime colleagues, and I want to assure any lawyers who are here that none of our conversations be interpreted to constitute my making a request of Katia, the Federal Reserve System, or the FOMC. (Laughter) I think we're clear.

Our second panelist is Jared Bernstein. He's a Senior Fellow at the Center on Budget and Policy Priorities, and he's been very active for many years thinking about the labor market, inequality, and macro policy from his positions both within the Obama Administration and in various think tanks here

in DC. And you can read more about his thoughts at his blog on the economy.

So let me turn the presentation over to them.

MS. PENEVA: Thank you very much, Stephanie. It's a pleasure to be here.

So in the spirit of making disclaimers, I should also make the disclaimer that the views expressed here and in the following discussion are my own, they don't necessarily reflect the views of my colleagues at the Federal Reserve Board or the research staff at the Federal Reserve System as a whole.

With that said, I will start my presentation by illustrating some of the points that our former Fed Chair Janet Yellen made in her opening remarks. So the first chart is a chart of the four quarter changes in U.S. core inflation as measured by the PCE price index since the 1970s. And you can see that inflation dynamics have change dramatically over the past half a century. Over the past 25 years, inflation has been considerably lower than over the preceding 25 years. Furthermore, over the past two decades, core inflation has moved in a relatively narrow range, despite big swings in oil and other commodity prices, the great recession, and unprecedented monetary policy actions.

So I think we can say that over the past two decades core inflation can be well characterized empirically in terms of transitory movements around the stable long-term stochastic trend. These fluctuations in turn can reflect changes in slack, supply shocks, or other temporary influences. And economies view the stability of the trend over the past two decades as resulting from better anchored inflation expectations, or the inflation outcomes themselves that have been engineered by monetary policy, however, there is not that much hard evidence to support that view.

Now, turning to slack, I just want to give a little bit of a background about the Phillips curve. In the late 1950s, William Phillips documented a negative relationship between wage growth and the unemployment rate. And soon thereafter economists confirmed this relationship for a lot of further developed economies. Now, labor costs are about 60 percent of the firm's production costs. So intuitively, they should matter a lot for the pricing of firms. And indeed, in the mid '60's (inaudible) pointed to a negative relationship between the unemployment rate and price inflation, which we now refer -- and we refer to this negative relationship these days as the Phillips curve. This curve, this relationship, has also changed a lot over the past half a century, so what I have plotted here, the black line, is still again core inflation in the U.S. and the green line is the difference between the unemployment rate and an

estimate of the natural rate of the unemployment, which in this case is the Congressional Budget Office estimate.

And when I talk about the relationship having changed, I want to point out -- the gray bars are the recessions -- I want to point out that in the early '90s and the early '80s, when the unemployment rate moved up above the natural rate of unemployment, which means the green line went above the zero line, inflation declined markedly, and in addition, each of these recessions had a persistent effect on inflation.

Now, if you look to the latest 2009 recession, you don't see such a decline in the inflation even though the unemployment rate cap went up. And so inflation didn't come as much as it did in previous downturns and the models we were using back then could not explain the behavior of this inflation. So the failure of the models to explain this have triggered a lot of research and a lot of papers. And I'll just mention the names of a few of those papers, Robert Gordon's 2013 paper was "The Phillips Curve is Alive and Well", but then Murphy, in 2018 wrote about "The Death of the Phillips Curve", Blinder in 2018 "Is the Phillips Curve Dead?", and the most recently, Hooper, Mishkin, and Sufi's title was "Is the Phillips Curve Dead or is it Just Hibernating?". And I think there's a fairly broad consensus that the relationship between unemployment and inflation has changed, but I don't think economists agree whether inflation has become completely disconnected from the (inaudible) activity.

So today I will argue that, yes, the Phillips curve relationship is not the same as 20 years ago, but it has not completely disappeared. And I think that the Phillips curve framework is still a useful framework to think about when discussing inflation dynamics.

In the rest of my presentation I will provide an update of research that I have done with Gerry Mirat, one of my colleagues who is also here, that he has allowed us to look at the responses of different economic variables over time. So the model is a vector autoregression model whose coefficients are allowed to change over time, which allows us to look at responses. And on the left panels we have plotted the responses of labor cost growth to an unemployment gap shock, and on the right it is the responses of core inflation to an unemployment gap shock. Just forgot to mention, in this VAR we have four variables, a measure of inflation, which is core market based PCE inflation for the U.S. relative import prices, a measure of slack, which is the unemployment rate gap, and wages, or unit labor costs in this

case.

And as you will see, in the left panel the response of labor cost to the unemployment gap shock have changed, but not that much. At the same time, the response of core inflation to unemployment shock has changed a lot. And this is the same thing you can observe in standard Phillips curve models. What I will also say that is even though the red line, which is the latest response to an unemployment gap shock is very small, it's not nonexistent, it is still there. And if you look at the decomposition of recent movements in inflation, so the inflation is plotted as the black line, there is a baseline forecast from this model which is the red dash line, and then the base line model plus the effect of the structural shocks. In this case we will look at the effect of the unemployment gap shock. And you can see that the unemployment, or (inaudible) economy is still an important factor for low frequency movements in inflation.

So since this is a discussion of labor markets and inflation, I would like to address one question that we very often get, is are we measuring slack appropriately, is the unemployment gap an inadequate measure of slack. And these are all good questions.

But going back to this picture, I want to point out this thing, the fact that we don't see a flattening of the wage Phillips curve, but we see a flattening of the price Phillips curve. It means that it would be very hard to explain what we see on the right, but what we see on the left, it's just not coming entirely from the labor market developments. And there are other things going on, and that's why we are not the only panel presenting today. (Laughter)

So against the background of all these changes, long-term changes in inflation dynamics that I plotted on the first slide, it has become increasingly difficult to discern the effect of a single factor. That doesn't mean it's not important, it's just difficult and can be obscured by other factors that are affecting inflation.

So before I pass on to Jared, I would like to again reiterate two things. Over the last couple of decades we've seen two major changes, one is the change in the trend, which is now much more stable, the second is that we have a flatter Phillips curve. The thing is we don't perfectly understand the reasons behind those changes. We have hypotheses and a lot of research has been done and a lot of research is going on now, but I don't think we have a very good understanding of what's driving them,

which leads me to the final point. From a policy perspective it is worrisome how much do we think these trends will continue in the future, what will take us to move them away from there, and can we exploit the stability in a productive way.

Thank you. (Applause)

MR. BERNSTEIN: Well, thanks very much and thanks for inviting me. The Hutchins Center always comes up with the most interesting topics and gets, present company excluded, the most interesting people to talk about them, so this is a real great opportunity.

I'm going to buzz through a number of points that have just been relentlessly made today, so I don't feel I have to spend my precious time on them. The first, Katia took us through in extremely clear fashion. Others have noted that wage PC is steeper than the price PC, and I think that is important for what I'm going to talk about in a somewhat different way that hasn't been raised today, although Janet Yellen referenced this in her talk, and that is the opportunity that the persistence of low and stable inflation in the flatter Phillips curve provides for us in terms of achieving much tighter labor markets persistently and the benefits that those yield to people who are frequently left behind in slack periods. And so that's going to be the core of my discussion to you today, the opportunity that these dynamics present to us in helping some folks who really need the help.

The labor market actually -- as Katia suggested, we are here to try to talk about the role of the labor market -- it actually explains an increasing share of the variance of prices, more so than I thought, but we still have -- that doesn't undermine the opportunity that I mentioned. And these gains, by the way -- this won't surprise this crowd -- the gains that I'm going to talk about and show you that are engendered by this opportunity, they're not just about equalizing wage pressure. I tend to in my presentations about this -- because I've been working on this area and the benefits of full employment for a long time -- I tend to emphasize how the elasticities are larger for lower paid workers, and that's really important. And in that sense full employment is equalizing.

What I'm going to talk about today is more about labor opportunities for people left behind on the labor supply side. The kind of canonical now story about the wage Phillips curve being more steep and on the left hand side quite nonlinear, this just the unemployment gap plotted against a principle component's mash up of five different wages series, it's a very familiar line. On the right hand side it's



much more of a random story. The one thing I wanted to raise about this -- or the two things I want to raise about this today is the first, which is consistent with my them, which is that less wage price pass through, which is the implication of this and something we've already heard about from this stage today, not zero, but less wage price pass through further underscores the opportunity of a flat Phillips curve to run lower for longer unemployment and tap the benefits that I'm going to show you in a minute.

But I also think that this slide poses a bit of a challenge to those who want to argue that the regional Phillips curve is perhaps a more important one or a more valid one, or certainly a better identified one given the variance and the observations, which is a lot more variance than unemployment if you get below the sub-national level. Well, we have wage Phillips curve that's actually decently identified from the national data and it's tapping the same national variance in the unemployment rate. So I guess I'm very interested in the fact that the regional Phillips curve tend to be steeper, the ones at the MSA or the state level, but I'm not sure that that seals the deal as to solving the mystery because the national wage Phillips Curve remains alive and well.

So how much variance does the unemployment -- does the labor market explain anyway? So this is a very, very simple exercise that I think is hopefully somewhat revealing in the sense that if you just regress the change in core inflation on inflation expectations. And then you take that residual, so you net out the part of the variance inflation that's explained by expectations and then you do a rolling regression on the residual using the U-U\* or the Ugap series. And I think so far today we've only used CBO's U\* just because that's just a mouse click away, and so there's that.

And then you just start peeling off the R-sq's from that. So this slide shows you how much of the variance in inflation does the labor market, or at least the unemployment gap, explain. And in recent years it hasn't explained very much at all, but it started to climb up. And this is very much consistent with Katia's point, that it's not everything, but it's not nothing either. And, in fact, something like 12 percent of the variance is explained, and therefore 12 percent of our time today should be spent talking about the labor market. (Laughter)

Okay, this is the core of what I wanted to talk about. These dynamics create an opportunity. Yes, there's a flat Phillips curve, but at least as important, we've had of course decades of higher inequality, long-term real stagnation for middle and low wage workers, lots of people in places left

behind, and bargaining power deficits that are offset by full employment. And so I recently wrote a paper with Keith Bentele where we concluded that these changing inflation dynamics, in tandem with the bullet points I just went through, should create an asymmetry of the Fed's reaction function as such dynamics elevate the benefits of full employment and diminish the risks of inflationary pressures.

Now, I say that with recognition of Janet's point that those risks haven't gone away and, in fact, the flat Phillips curve could be a problem on the other side if you're hit with persistent inflationary shocks. I also cite David Mericle. He's an analyst from Goldman Sachs, I think a very insightful inflation analyst, and he makes the same point. And I only put that in there because he's -- you know, I'm sort of associated with the left side of the spectrum, and so there's my point. Here's an inflation analyst arguing that the tight labor market poses less risk today, and policy makers can exploit the disinflationary effects to run the labor market hot as long as inflation expectations stay anchored. I think that's really important and the key to my presentation.

Here is some new work that I just released this morning on my blog with Keith Bentele. It's going to become a paper for our full employment project. And this gets to the benefits of full employment in ways that you probably haven't seen before. We look at all the different quintiles, but for this particular presentation I'm focusing on the lowest income workers looking at prime age workers, and on the left hand side you basically have what's an employment rate, it's annual measure, so it's a little different than the employment rate that we look at every month from the BLS. But what this shows is the blue line is the employment rate, and it's very cyclical. So these folks are very responsive to the cycle in terms of their labor supply crossing the extensive margin. And the prediction there simply uses the unemployment rate and a lag dependent variable to predict the line. And at some level you're just saying, okay, one cyclical variable predicts another cyclical variable. This is the only quintile it works for. If you look at three, four, or five, you don't see much at all. So it's particularly a story for low wage workers. They are the ones who are going to be most helped by this opportunity that low inflation bequeaths to us.

And so what I have on the right -- I know there are a lot of numbers there, but I'm just going to focus on the circles ones. So we look at the share working in the bottom quintile, and I'm looking at the 1990s, because it was such a high pressure labor market. Now, some of you are thinking there was a lot of other stuff going on in the '90s, there was welfare reform, the ITC expansion, minimum wage

increased, all true, but there was also a really high pressure labor market. And, in fact, if you look at the earnings of low income workers, and this includes zeros, okay, this is if you have earnings or if you don't, they grew by 50 percent or 50 log points. And because the three columns are multiplicative to the all earnings columns, you can do a log decomposition. And basically the story is that half of that increase, 23 percent over 49 percent, or almost half of that increase, is crossing the extensive margin coming into the job market. If you look at for African Americans, their earnings -- and I'm including zeros -- so annual earnings, including zeros, more than doubled over this high pressure labor market and half of the increase was crossing the extensive margin, was increasing in the share of work. And that shifts in reverse in the bottom panel. You know, when the economy snuffles, more economically vulnerable folks catch pneumonia. And if the downturn half of these income gains were reversed, fell 50 percent, and 3/5 of that decline was people crossing the extensive margin the other way.

So the costs to the slack in the job market are particularly borne by this group, but the benefits are quite pronounced. In our paper we also show the most recent period, the one we're in right now, of tight labor markets. And while the gains aren't as dramatic as they were in the hot '90s labor market, they are comparable and they are economically significant and large. Very important to these folks.

So now what I have here is just the unemployment gap and thanks to my excellent RA I was able to do a dynamic slide. (Laughter) And here just some headlines, recent headlines. So these are headlines over the last, you know, few months, tight labor market, disability may not be a barrier, I thought I was done, open doors for convicts, lower-income Americans are increasingly job hopping in order to tap some wage increases.

So in conclusion, I want to thank the Federal Reserve for recognizing this opportunity. And if you listen to the words of Jay Powell, and other Federal officials or former Federal officials who are here who aid much of the same thing, you will hear him expressly making these connections. So I wanted to thank the Fed for that, for tapping those benefits. And I also want to thank the American people for their anchored expectations (laughter), which are key to all of this.

Thank you very much. (Applause)

MS. AARONSON: Okay. So I just want to thank out panelists again for those great

presentations. I have a lot of questions. We probably won't get through them all today.

But one of the things I am curious about is how you're interpreting what's currently going on in the economy. So I think you both asserted -- and we've heard other people this morning assert -- that while the price Phillips curve seems to have flattened out a lot there is still some action in the wage Phillips curve. But when I look at wage growth now it looks to me that it's running at about the pace you would expect given productivity growth and inflation. So that doesn't actually seem to be suggestive of a hot labor market, which is how a lot of people are characterizing. And I'm sort of curious how you interpret that, is it actually some attenuation of the wage Phillips curve, are there other things going on, is the natural rate much lower? If you guys could give your thoughts on that.

MS. PENEVA: I'll start. So on that question, my presentation was more focused on the long-term changes, but it has been a constant question why isn't inflation back to target, why aren't we at 2 percent. And if you remember the chart I showed, decomposing recent movements on inflation and how slack can explain why inflation was below the baseline forecast during the recession as the unemployment rate was high, it has gone back to zero, so we don't get anything from slack at this point, which is understandable. But we are still not back to zero.

So what has happened, if I had plotted -- if I had time to show another chart, I would have shown one that not only adds the structural effect of the unemployment rate, but also from import prices. And that could explain a lot of what happened in '15-'17 and '18. But it doesn't get us all the way there.

And the third thing on which I didn't have time to focus was on the stochastic trend too much. And if you go back to the first chart, you will see that the stochastic trend and also the baseline forecast from the model is now 2 percent. It's more something closer to 1 3/4. So even though the trend has been very stable, it has not been at 2 percent. So it's my explanation for the last few years.

MR. BERNSTEIN: I think there are three explanations to your excellent question, because I think you're right. The first is that actually there has been a little stronger wagger at the bottom, so you're citing the average. So this is consistent with my earlier point that the elasticities of wage growth relative to the tightening job market are stronger at the bottom of the scale. The second point is probably the most important, is that probably the job market really isn't quite at full employment yet. That may sound, you know, somewhat controversial given how low unemployment is relative to these estimates of

U\*, but there's a huge confidence interval around estimates and just based on the inflationary data and the wage data, we can get as complicated as we want, but I think a sort of first order simple realization is that we're probably not yet at full employment.

And then the third thing is, you know, worker bargaining power has just been so severely diminished that it's going to take not just low unemployment but very low unemployment for a very long time. Remember, the unionization share in this economy now in the private sector is somewhere around 6 or 7 percent.

MS. AARONSON: Okay, thanks.

So another question I wanted to get at was to try to tease out a little bit more what you think is going on about wage pass through into prices. So some of our other speakers this morning have talked about, but look at it from the perspective of the labor market now as well, you know, we still see some evidence of a wage Phillips curve, much less of a price Phillips curve. Wages have picked up a little bit, inflation has been pretty flat, you know, core inflation.

So what your explanations for why these changes in wages aren't translating more into inflation, price inflation?

MS. PENEVA: So this again we'll build on research we've done with Gerry Mirat on the pass through from wages to prices because doing what we do at the Board, this is a question we very often get and we struggle to explain why we don't include wages on the right hand side of our price Phillips curve equations.

So we again looked at the pass through from wages to prices over time, and depending on what measure you use, if you use the more comprehensive compensation parameter, you could see a stated decline over the years to the point where you don't see a pass through from wages to prices. If you use the employment cost index, it's more stable, but not very big.

Now, this is not to say that wages don't matter for prices, they should matter, they are 2/3 of production cost. But I think what we found in this paper, that if you plug in addition to the stochastic trend that I showed for price inflation, if you do a similar one for unit labor costs, you will see that they are both very stable. And in this stable stochastic trend environment, it's very hard to identify movements in wages that are translating to prices. In fact, what you find is that year to year movements in price inflation

can reflect slack and can reflect import prices or other idiosyncratic factor, but it's hard to identify movement pass through from independent wage movements to prices.

MR. BERNSTEIN: I don't have a ton to say about this, but two points.

One is I really do find this relatively new literature on the impact of firm concentration within key industries to be relevant to this conversation, to this question. You see this in retail, you see it in healthcare, you see it in technology, dominant firms. Now, I sort of grew up in an economics where when sort of monopolistic firms took hold saw it on the price side. We're not seeing it as much on the price side, where we're seeing it is on the labor cost side. So some good papers where firm concentration appears to be correlated with diminished labor share. So using your monopoly power to kind of screw workers instead of on the price side. And I obviously think that's problematic and I think the tight labor market is starting to push back on that, even though labor share is still uncharacteristically low. Even with a recent revision that took it up a bit, it's still uncharacteristically low. And I walk around thinking that this is an important source -- and I always tell this to my friends on the Fed who will listen to me -- the important caveat (laughter) -- that there is room for non inflationary wage gains through a rebalancing of factor share, through labor share catching up to something to its closer historical levels.

Now, that's not a slam dunk because firms will resist that and may try to pass it through on prices, but we haven't seen a lot of that as your question implies.

MS. AARONSON: So I guess related to this we've heard some talk this morning about whether we should be focusing on alternative measures of slack, if the unemployment rate -- I mean the unemployment rate was never a comprehensive measure of slack, it was more a sufficient statistic for slack, but I think this does raise the question of whether it no longer serves that role as a sufficient statistic for slack and whether we need to be looking at a more comprehensive measure, and we're getting a mixed signal about how much slack there is.

MR. BERNSTEIN: Do you mind if I start with that?

So I think that that is a fine point and we should all try different measures in our model, but it is actually -- in my view at least -- statistically kind of overblown because -- I recently did a blog on this where I just correlated the unemployment rate with all the other measures I could think of and the correlations are really, really high. I mean they're all above .9 as for the most part. And my friend, John

Roberts, is in the audience, an excellent Fed economist, and has done some work on sort of throwing a bunch of these slack variables into a kind of Kalman filter washing machine and seeing what comes out. And as I believe, John will correct me if I'm misrepresenting this, you know, the unemployment rate kind of dominates. So, yes, sure, other measures, but I wouldn't spend a ton of time on that.

MS. PENEVA: And now just to reiterate the point from my presentation, I think it's a very valid question and certainly one we should be looking at, but the fact that we don't have the flattening in the wage Phillips curve means there is something else going on in the price Phillips curve that does not come from bargaining necessarily, bargaining power or the right measure of slack.

MS. AARONSON: Great. So the last question I want to ask before I turn it over to the audience is -- actually, Katia, I'm going to pick on you a little bit -- which is Jared came out very strongly saying not much inflation, Phillips curve seems flat, we have an opportunity here, you were sort of expressing I would say some concerns at the end of your talk and I was sort of curious like do you think we have the space that Jared asks knowing that this is -- you're not speaking for anyone in the Federal Reserve System (laughter) -- or do you think that the risks sort of dominate?

MS. PENEVA: So since I'm not speaking for anybody, I would say how I spent my days at the Fed and in the morning I worry we are never going to get to 2 percent and the line trend is lower. We have to do something. In the afternoon is like what if they are non linear, what if we lose control of inflation expectations (laughter) and we overshoot. So I think I am worried that, for example, if you look at the Michigan survey, expectations have moved lower and some would argue that that's because people are just waking up and realizing inflation was never 3 percent, but that might not be our data, it might be just a reaction to persistently low inflation that we've seen. And it would be great to push those up, by only 3/10. (Laughter) And if we can do that, that's great. My concern is that how confident are we that we can run the economy hot to get it exactly -- so, again, I am on both ends worried.

MR. BERNSTEIN: Yeah, I don't want to create the misimpression that I'm operating from a nothing to worry about kind of perspective on the threat of future inflationary pressures. I mean I guess the thing I take from the conference so far and all of the reading I've done up in recent years on this, is that I don't think we have a great -- and I think I've heard Janet say something similar -- she'll correct me if I'm wrong -- I just don't think we have a great understanding of what's driving inflation dynamics these

days. And that means that for now, based on the empirical evidence that I and others have presented, we can tap the benefits that I was stressing as being so critically important to tap given the history of what's befallen middle and low income folks.

But when you don't know -- you know, what you don't know can help you but it can also hurt you.

Hey, before we get to the questions, we have three labor market analysts up here and I don't think you should just ask questions, I think you should have to answer them. (Laughter)

Stephanie, et al, did a really important paper on the impact of tight labor markets recently. I think it was a Brookings paper. And one of the things you talked about was something I think very important that Janet referenced in her early comments, and this is the possibility of reverse hysteresis, which sounds like a really bad disease, but it's actually -- well, it is the reversal of a bad disease. And what Janet was referring to was the possibility that -- my slide showed all these people coming into the job market and yielding benefits. Well, historically, there has been a problem of last hired, first fired, and people get into the job market but they don't stay in the job market. And the idea is that perhaps tight labor markets can actually improve the supply side of the economy by pulling people in in a lasting way.

And I know you have thought and written about that and I really want to hear what you have to say about that possibility.

MS. AARONSON: So it's true. So in this recent paper that I worked on, we did find a little bit of evidence, particularly along the participation margin, the extensive margin, that hot labor markets do pull people in and it has a bit of a persistent effect. And I think our result was consistent with some of the micro literature. We used time series data which I think have their limitations for looking at this issue. But it's consistent I think with the micro literature, which has found some short-term effects that when people are pulled into the labor market and become employed, that they remain employed for a bit longer. And so there are some lasting effects. And, as you said, this question is very crucial because if there really were significant hysteresis effect where the -- you know, by running the economy hot we could really boost labor supply, that would reduce the tradeoff that the Fed would face in setting interest rates.

So the one thing I've been thinking about is why aren't these effects bigger. I think we all



have the kind of intuition that once someone comes in, they gain experience, they create networks, that they should have a more long-lasting tie to the labor market. And I think part of the issues precisely what you said, that the economy largely operates as last hired, first fired, and people tend to be hired into very cyclical industries because those are the ones that are expanding employment a lot late in the cycle.

And also then we don't run the economy hot for very long. The periods in which the unemployment rate that is below the unemployment rate is below the natural rate, they just aren't that long. And I think actually if you look to some other experiences in history that aren't dependent on the business cycle, you actually see better evidence of hysteresis. So in thinking in particular about women's entry into the labor force after the Second World War, that went on actually for a number of years and it really significantly boosted women's labor supply. It was a permanent effect. Lots of women left the labor force in the '50s, but if you read the literature on this, it really laid the groundwork for women's entry into the labor force by changing the way families operated, by changing the structure of work in institutions.

And so I think there is a powerful case that hysteresis can matter, I'm just not sure it's the business cycle frequency, at least to the extent that we've let it operate in recent years that you would see those effects.

MR. BERNSTEIN: I think one of the problems is that we all talk about this from the perspective of macro economics, which is fine, that's certainly a great baseline. But it will actually take micro policy to achieve reverse hysteresis. That is, we're going to have to do stuff to help people who face large labor market barriers when the macro economy helps them jump over those barriers, and then macro economy goes south. We're going to have to do stuff to help keep them in the job market, including job subsidies, training programs, and things of that nature.

MS. AARONSON: Okay. So let me see if we have time for a few questions from the audience. Let me just gather a few. Danny, I think I see your hand.

SPEAKER: I want to answer your question. Hi, Jared. I want to answer your question about what variables actually enter wage equations. I've worked on this for the last 30 years.

Turns out that in the UK and the U.S., and everywhere else, post-2008 there's one variable that works and nothing else does. The unemployment rate doesn't work, U7 works. And what U7 is, is the thing that drives U6. It's part-time for economic reasons over employment. And the reason

it's sort of really quite good variable, which explains why there's no inflation, is it hasn't been reverted, it hasn't been reverted in any country in the world.

So when you run a wage equation in the U.S., post-2008, the unemployment rate doesn't enter -- sorry, Jared, it doesn't -- but the under employment rate does. So that's the answer to your question. I have several papers on it and a new one coming in in the ILR review. But it's the only variable in the UK, in the U.S., and in panels of European countries.

So I don't buy your comment that the unemployment rate works. It doesn't work.

MR. BERNSTEIN: No, I'm sympathetic to that. We actually -- I'm a little embarrassed because we published one of your papers.

SPEAKER: I know you did.

MR. BERNSTEIN: With great respect for you and your work, and I think you're, you know, largely right, I do get a little nervous when economists glom onto one variable that they really love. That often doesn't end well.

MS. AARONSON: Over a short period of time.

SPEAKER: (Off mic)

MS. AARONSON: All right. Silvana, do you have one?

MS. TENREYRO: Yeah. I just want to come to your question on why the Phillips curve for wages is steeper than the price.

Central banks are targeting inflation. So to the extent that they are successful at it, inflation will be fairly constant and uncorrelated with everything, including slack. Now, you might wonder, okay, why are we slightly undershooting -- in the case of the Fed, not the UK. Maybe there is scope for more expansionary monetary policy. But the Fed is not targeting wage inflation and so that relation is freer to some extent. It's not (inaudible) for my policy.

MR. BERNSTEIN: Makes sense.

SPEAKER: So the lower income folks who are -- they can't get unions to help them, so they go to the government and the government somehow becomes populist enough to really contemplate a major minimum wage increase.

So, you know, but the low income people arguably would be the most affected by inflation

too because they spend a greater proportion of their income on necessities. So how high can we put the minimum wage without jeopardizing their security at the bottom fifth?

MR. BERNSTEIN: I will speak to that. But first let me point out, one of the reasons I really enjoy hammering on this full employment, the benefits of full employment piece, is that it is pretty nonpartisan. I mean everybody should support that. And it's not government necessarily doing stuff. I mean the Fed is in the mix, no question. But it's really, you know, markets working for low income people.

You know, I guess from the evidence I've seen that you could go to \$15 on a minimum wage, which is something that has been proposed, but you would really have to phase it in over a long period because there are places in the country where \$15 an hour gets you to probably now around 40th percentile wage, and so, you know, you'd want to phase it in slowly. But I think with a long phase, I think the research would support that idea.

MS. AARONSON: Okay. I'm going to have to end the panel now. Thanks again very much to our panelists. (Applause)

MR. HUTCHINS: Let me introduce you all then I'm going to ask (inaudible). Do you go first?

MR. BERNANKE: Okay.

MR. HUTCHINS: You have to wait for the mic. Thank you all for, continuing the conversation. It's almost hard to believe there's anything left to say after those panels. So, I was going to propose, that we do this whole thing in RAP (laughter) or maybe in Finnish (laughter), but I thought that was a little unfair given that I haven't given the panel advanced warning of that.

MR. BERNANKE: That's right.

MR. HUTCHINS: And also, you wouldn't want to hear me. So, I'm joined here by Olivier Blanchard, who's now at the Peterson Institute, formerly of the International Monetary Fund and MIT; Loretta Mester, who is the, president of the Federal Reserve Bank of Cleveland; Ben Bernanke, of course, the former Fed chairman and our colleague here at Brookings and Paul Krugman, the economist at City University of New York now, right?

MR. KRUGMAN: Yep.

MR. HUTCHINS: And a columnist for the New York Times. Krugman is the guy who makes all journalists nervous because he seems to be more productive than the rest of us. And that's kind of frightening given that he does all these other things on the side, but we can discuss that later.

So, I wanted to start by asking each of the panelists a little bit about what they took away from the conversation we had this morning. I want to start with Olivia who it makes the observation in this slide that you see behind us about the -- that's been made about how the Wade Phillips curve behaves perhaps as one might have expected the price, but prices aren't rising. And So, the question is what the hell is going on?

MR. BLANCHARD: Okay. So, I had prepared a slide in anticipation and I think it has survived the previous three hours fairly well and coincides with a general message and it tells us where we need to look and what implications it has. So, the diagram on the, which slide is it? This one it's familiar except it's not in familiar form, but it basically has the inverse of the unemployment rate and the rate of inflation -- of wage inflation measured by the employment cost index. And I think the correlation is that you could plot it in a scatter diagram, but it's there and I think that's consistent with everything we've heard.

Now, what people have put on the right-hand side typically is the Phillips curve, the Price Phillips Curve. What I've done instead of is plot, the again, the wage inflation using the employment cost index, which is the blue line and the GDP price deflator which for the purposes of thinking about markups is clearly much better viable than the CPI. This is what we produce. And basically, it's visually striking, which is that although we saw from the previous graph that the wage inflation was kind of okay. Price Phillips Curve was okay. There doesn't seem to be much of a relation between the GDP price deflator and the ECI employment cost index. It's really where there is clearly a disconnect.

People have talked about the low pass-through. It's true, but there is much more than that. There is a lot of variation that in the price index, which is not coming from the cost index to the (inaudible) these two dimensions. So, starting the by my reactions to today. So, I think the first puzzle is the slope of a relation between wage inflation and unemployment. On this, I think we're not clear as to where the slope has really declined or not. My sense from my own regressions is that it has, but somebody argued that if you do it right, it really has remained more or less the same. I think it has

decreased.

The civil tenuity, explanation, I think, is a very plausible candidate subject to kind of a test that I suggested. But it seems to work. The other is that maybe there has been a change in the bargaining structure on wages. I mean the -- they take the case, basically, we think of bargaining is splitting the ranch from a match. Well, if the workers are already at the bottom end, there's nothing which can be done to decrease their wage. So, if everybody was paid the minimum wage, then we would find no effect of unemployment on wages. So, I think there's something like this happening that I don't think we solved that one and we need to do it.

On the markup in the second, the second graph, is it -- what is it, what is going on? I suspect measurement is a big part of it and the more you know about the GDP deflator, the more you worry. But we've heard various explanations about pricing. I think some of them say, well some sectors really have to take the international prices given and therefore, you will not see the kind of pass-through, but that's not to fall sectors. I think here we need to go sectoral in the same way as was done for labor and try to understand it. So, that again, I think that's still work to be done.

On the policy implications, which is the theme of the panel. This actually, I mean, the stability of a Wage Phillips Curve in the instability of the Price Phillips Curve has a fairly big implication, which I think hasn't been examined and should probably have been in the context of thinking about what the Fed should do, which is to have a wage inflation target rather than a price inflation target. I mean, it clearly is much more related to labor market development. So, from just a non-political point of view, it seems like a better measure to actually look at. But from a normative point of view, if you take a New Keynesian mode and the markets reflect larger distortions then actually it's a good idea to take a measure which doesn't have a markup in it, namely, the wages and basically focus on this.

So, if when you see wage inflation at 3 percent and you see productivity off at 1 percent then you're home. Even if a GDP deflator in my case, but the CPI over core CPI moves around. So, we had talked at the dinner with Janet and we said we would write a paper together. Janet has been a bit busy, but I think that's still worth exploring. Also, politically actually telling that telling people that the Fed cares about wages and as wage inflation is a target is probably a plus in addition.

MR. HUTCHINS: So, that, does that mean you'd be tightening now because wages are

rising?

MR. BLANCHARD: I would basically think that we are more or less at full employment. Right. And wage inflation is about three something in poly activities around one. That's consistent with the price level correctly measured of about two. Yeah.

MR. HUTCHINS: I see.

MR. BLANCHARD: I'm more on the hawkish side these days --

MR. HUTCHINS: Oh my goodness.

MR. BLANCHARD: -- then Jared.

MR. HUTCHINS: Loretta Mester. So, I've noticed that in a number of your presentations over the recent months, you have a lot of things. If it's the case that non-monetary structural factors are holding back measured inflation, then that's a very different implication for policy than if it's an aggregate demand shortfall. So, I'm sort of just sort of curious what sense you make of all this evidence that we've heard this morning on what's driving inflation in the work that you've done and your people have done at the Cleveland Fed; what explanations do you buy for what we've seen?

MS. MESTER: Yeah, So, I grew up in Baltimore, So, H.L. Mencken is from Baltimore. So, he had this line basically that said for every problem, right, there's a simple elegant solution that's wrong. So, there's no -- I don't think there's a simple one word answer to this. So, yes, our inflation research center is doing a lot of work in trying to understand inflation dynamics. So, we have results that basically say, if you look at structural part of inflation that is related to the labor market and the a cyclical part that the cyclical part and the a cyclical part, or structural part. There's only --

MR. HUTCHINS: You mean the cyclical part is prices that usually move --

MR. MESTER: Move with labor market tightness, right.

MR. HUTCHINS: And the a cyclical part of things, like maybe health care price --

MS. MESTER: -- are things, idiosyncratic shocks, healthcare, which is the big part of it. Other parts that aren't really related that the cyclical part is only 40 percent, right, of the inflation now. So, part of what's going on, I think, is that you have idiosyncratic factors that affect the labor market, but -- effect the inflation rates. And it's not just the labor market and tightness in the labor market, but if you do just look at the cyclical part, it certainly is correlated with tightness in the labor market. So, I believe there

is still this relationship and that we can use it to help predict inflation.

That said, you have to recognize that there are these cyclical factors affecting measured inflation. And so, I think he wanted to be careful about sort of trying to explain everything with what's going on in the labor market. So, that means that if you see a shock, it may take longer to get back to your inflation target than it would otherwise. From a policy in explaining in a communications point of view, you may want to be thinking about a range as opposed to a point target because you have these shocks that are going to move inflation off of your target, even if your trend inflation rate is moving up.

And so, there are implications for how you think about, how you communicate your target and I think the results we saw today on inflation expectations were very provocative in the sense that it makes you think about a different way of communicating and perhaps a different way of thinking about the interplay between inflation expectations and your target.

So, from my point of view, you might have shocks that move inflation off your trend, but the trend underlying inflation rate, it's going to be driven by inflation expectations. And so, I agree with the remark that Janet made in the beginning that the stability of inflation expectations is key to allowing you to be able to run your monetary policy. I think the results that talked about the Amazon effect and the fact that pricing models are changing are very interesting because if it's true that prices are becoming more flexible, right, if you think about an a DSG model, right, why is monetary policy able to cushion against these shocks on the real side, it's because of sticky prices.

If prices become less sticky because there's more frequent price changes that means monetary policy is less effective or said differently, you have to move your policy rate more to have the similar effects. So, again, these changes, these underlying structural changes I think are more important than just how do you measure inflation. They may actually change the transmission mechanism of monetary policy.

MR. HUTCHINS: Ben, are you convinced that something's changed in the structural side of unemployment, or is it just that for some accident of history, we've had wise monetary policy makers as Silvana points out and that everything's all the same. The only thing that's changed is the quality of monetary policy. (Laughter)

MR. BERNANKE: I went in and everybody's laughing. That's actually my opinion.

(Laughter) I think the most important factor over the long haul has been changing, not wiser monetary policy, but a monetary policy focused on anchoring inflation expectations. If Mark Watson and Jim Stockton had a really nice paper where they studied the dynamics of inflation using a so-called unobserved components model. And the basic message was that 30 or 40 years ago, if there was a shock to inflation, a significant part of that shock was permanent. It would stay away from its initial point for a sustained period. Whereas, since the '90s, if there's a shock to inflation is transitory and you go back to the underlying level and that's consistent with a world in which inflation expectations have been well anchored. And so, shocks to inflation tend to be transitory as long as that policy's consistent with that. That is by the way, savant is a way of thinking about it, the endogeneity of policy, I think that's very complimentary.

On the one hand, if inflation expectations are very well anchored, then policy can relatively easily succeed in keeping inflation at target. And vice versa, if policy's committed to keeping inflation near target and inflation expectations tend to be well anchored. So, I think that explains the broad changes in the inflation process. And it probably helps at least to a first instance to explain their most recent behavior. Part of the reason why inflation didn't fall so much in the recession was because inflation expectations were well anchored on the downside. They probably did fall some extent. We've seen some evidence that inflation expectations fell, which is probably part of the reason that inflation's been slow to come up. Having said that, I think there are a lot of interesting points made today. For example, clearly part of the reason that inflation has been slow to come up is that the Fed underestimated how far the labor market could be pushed along with what Jared talks about. Youth Starr unemployment, natural rate of unemployment is probably a good bit lower than the Fed thought a couple of years ago and that gives some scope for further, expansion in the labor market. Some of the points that Kristin made about the global factors that kept inflation from falling quite so much after the panic I think are relevant and the transmission of that to prices. So, there's a bunch of -- in any short period is going to be a bunch of idiosyncratic and other factors that are relevant.

I think over a longer period, I do think that the change in the structure of monetary policies, the most important thing, but to all these other things obviously are relevant too.



MR. HUTCHINS: Paul, what sense do you make of all this?

MR. KRUGMAN: Oh, yeah, it's a -- maybe the most important thing is that we actually basically understand the economy a lot less well than we thought we did. I think that that has gone and which has a huge bearing on policy. I actually wanted to say something about Olivier's proposal because I have thought something along the same lines and then kind of backed off it even though the economics seems to be totally right. And here, here's the point.

MR. HUTCHINS: Talking about targeting wages.

MR. KRUGMAN: Targeting the wages -- there's one thing I, nobody really talked about it here, but the one huge success story of sort of conventional monetary analysis, over these past 10 years has been the distinction between core and headline inflation. I'm sure Ben remembers this even better than I do, but I we remember 2010, 2011 when headline inflation was going up, mostly because of oil prices and the Fed was saying, now calm down. It's core inflation that we should be looking at and was totally vindicated in that. But we're now seeing that there's some stuff going on even with the core inflation measuring. But if we think about conceptually what we mean by core, we mean stuff that is kind of sticky, sticky and the curious thing out there of the curious of the core is, in fact, wage inflation. So, it makes a lot of sense to say let's target wages, except I'm trying to imagine the situation of the chair of the Fed saying, "We are raising interest rates because wages are rising too fast." I just don't think I, I think it's good economics, but the political economy is just going to be disastrous.

MR. BLANCHARD: I think saying we have committed to make sure that wages increase not matter what, at 3 percent to your (inaudible).

MR. KRUGMAN: Maybe. I think we've, I think it's not just 40 percent of Fins, but a large proportion of the population as a whole that just doesn't get messages that complicated.

MR. HUTCHINS: Ben, your body language suggests that you're not ready to endorse the Blanchard Rule.

MR. BLANCHARD: I was just exactly having the same reaction that Paul did that I wouldn't want to sit in front of Congress and say we're very concerned that wages are rising too quickly. (Laughter) That's a concern. I think it's a complicated question. I mean there's elements of the price process which are independent of labor markets and I think need to fit factor into the monetary policy as

well.

MR. HUTCHINS: It seems that at the same time as we've had a long period of low below target inflation in many countries around the world, we've also seen this decline in Our Star, the so-called, natural rate of interest, the interest rate that will prevail when all is calm, which has been pointed out as, we don't know what it is, but there is certainly widespread consensus that it has fallen a lot. And I'm sort of wondering, it seems to me this is a -- well, two questions. One is, are these things related? And secondly, this is kind of challenging. How should monetary policy think about a world where inflation at least for now seems to be persistently low and the natural rate of interest, seems to have fallen and is also persistently low.

MR. KRUGMAN: So, I have a -- well, as you might say, somewhat facetious answer to the first part, which is a, So, it looks like Youth Starr in Our Star it's just things exist, which we're not even dead sure about that, but it looks on both of them have fallen. If you asked why has Youth Starr gone down, the answer is we really don't know. If you asked why has Our Star gone down? We really don't know. So, the common factor is both of them are caused by, we really don't know. (Laughter)

MR. HUTCHINS: I thought that the catchall answer is always it had something to do with demography.

MR. KRUGMAN: Well, that's what I -- that was going to be the next thing. If I had to make up a story, I'd say demography, but it's you can make a story along those lines. Although the fact that the Wage Phillips Curve is holding up better, it kind of makes it harder to tell a demographic story. If it was more, just a more experienced older workforce that should be showing up in the Wage Phillips Curve and it, which is, is the less dramatic part of the story. But I buy the demography on a secular stagnation story. I think that's right.

But what I would take from it, it's just the general policy lesson is, look, it seems quite possible. It's seem quite possible to acquire a lot of slack in the advanced world as a whole, we don't know that for sure, but it looks like there is. And at the same time there is very little monetary space in the world as a whole, which should give us a lot of anxiety. We should be worrying a lot because if we're in this situation now, when nothing really bad has happened lately, we're in big trouble if sooner or later if something really bad will happen. And so, I think the two factors together mean that we should be

worrying a lot about what can we do to give us some more space for policy response, which is going to get us, I think to some of the other questions that you gave us about inflation targeting and fiscal policy.

MR. BLANCHARD: Can I go back to the Our Star Youth Starr conundrum? I think it's a bit worse than we don't know.

MR. HUTCHINS: Great. All right.

MR. BLANCHARD: Because I think the main explanation for Youth Starr is really weaker bargaining power for workers. It seems to be fundamentally, and that seems to be good news for the other side, probably the capital side, the profit side and the R, the risky R. And so in that light, I think we're decrease in Our Star, which I think is there is even more of a puzzle.

MR. HUTCHINS: Great. So, Loretta --

MS. MESTER: Yeah, can I ask --

MR. HUTCHINS: Unfortunately, you have to make decisions without --

MS. MESTER: Yeah, well, we always have to make decisions out for form. I guess I'm going to push back a little bit on the fact that we have all the slack still out there. Because if you talk to firms, in fact, we had a panel yesterday at the Cleveland Fed. They routinely tell us, and this has been going on for several years about the difficulty of finding workers that they can hire. You push back on it and then they say, okay, are you raising wages? They'll say yes. And, but that's changing now. Okay.

Now, they're basically saying that it's not really worth trying to hire of the pool that's still out there. Because when they do bring them in, they don't stay on staff more than a month. And so, I say, "Well, do you know where they're going?" And they have no idea. It's not being been away for other wages. So, what is the response now? The response now is they're going to start automating more. And you've seen that in all these firms. So, I think I would say that we have done a lot in terms of running policy much more accommodative than we would have in the past. Partly that's because we brought down our estimates that Youth Starr. So, in Jared, so, in your -- if you, if someone were going to say relative to the old Youth Starr, we are running the economy very high. Our policy is much more accommodative that and would be on an old traditional Taylor Rules. On that sense, I think we've taken on board some of the things that you talked about in terms of we had to rethink when we don't see wages going up, or we don't see inflation going. We had to rethink our policy rule. And I think we've done that.

But at some point there are unintended consequences of doing a of a policy like that and so you may be ending up affecting long-term employment growth because if you automate more in these firms, you're not going to have the demand for labor as high. So, I'm very sympathetic to wanting to be at maximum employment. That's certainly our goal. I think the policy tool we have in monetary policy isn't really going to affect the overall labor market in the way that you want to. I think the things you pointed out in terms of the things that we talk about when we go out into the district, job programs, getting people -- the skill sets they need for running those robots that are going to be coming into these plants, all those things are going to have much bigger impact on public welfare in terms of getting people to work. There's a whole other set of issues about how to get people to work, which is another issue. Transportation's an issue. So, there's a lot of structural things that are nothing to do with monetary policy that can improve labor.

MR. HUTCHINS: Right, but I don't understand the problem. So, you run the economy high.

MS. MESTER: Yeah.

MR. HUTCHINS: Workers -- that we pull lots of workers into the labor market, wages start to rise, firms then start to automate, which increases the pace of productivity growth.

MS. MESTER: Yeah.

MR. HUTCHINS: And you're worried that we're going to run out of jobs?

MS. MESTER: Well, no -- yeah, I'm worried that there's going to be a whole segment of the population, right now, they don't have the skills that are in demand. And so what happens to those people? Unless you are training them for the modern jobs, you're in trouble. We've had a shift in our district from manufacturing to other types of jobs. There is a mismatch between the skills that people have that want to enter the labor market and the skills in demand. And unless we're doing something about that, it's going to be very hard to improve outcomes. And so I think that's one of the things that the Fed listen, conferences we're doing around the district.

We've heard time and time again, they're not that concerned about us hitting a 2 percent inflation target. They are much more concerned about and like to be able to provide food on the table for my family. And so, I think we have to think a little bit about what tools we use --

MR. HUTCHINS: Right.

MS. MESTER: -- for which problem we're trying to affect.

MR. HUTCHINS: Ben, can I steer go back to the question about the challenging combination of low neutral rates and low inflation. What is the right response of monetary policymakers? And does it matter where yOur Starting point is? Our inflation is close, getting close to 2 percent; Japan, their inflation expectations are still below 1 percent. What's the right answer?

MR. BERNANKE: Let me start by saying that I think that the decline in Our Star is mostly understandable. I think demographics, global savings and investment patterns, technology, all those things that a lot of people have talked about. I think they can explain most of what's going on there. I'm actually more puzzled about the Youth Starr decline than I am about the Our Star decline. So, I think I understand that it's something that's outside of monetary policy, but it's now a constraint on monetary policy. I think I want to do it half empty, half full kind of response to your question though. There's this correct point that historically the Fed is cut, the federal funds rate five and a half percentage points during recessions and now we only have supposedly three percentage points of have room.

Some work I'm doing in thinking about this, I think that if appropriate use of forward guidance, quantitative easing, some of these tools plus thinking about different frameworks for policy, I think altogether that they add about three percentage points in space, of space. And so my sense is that as long as nominal neutral rates are, say two and a half to three, something like that, that the Fed will be able to do most of what it could do at any point in history in terms of using traditional policy rules.

So, I think that say that we're now basically out of space. In the United States, that's wrong. It is also though true that once neutral rates get much lower than say two and a half nominal, then you are running into a much more difficult situation. And then we'll talk about alternatives, fiscal policy and the like, but I think that asking for five and six percentage points of spaces not needed, I think that these other tools in fact are effective and if appropriately used can compensate for some of that, a loss in our store.

MR. BLANCHARD: These other tools already used. Your 3 percent, some of has been used already, so it's not --

MR. BERNANKE: Well, they can use better and more aggressively, number one. But

number two, I'm just talking now about the next recession and how, what the Fed will be able to do starting from where it is a, if there is a medsize recession --

MR. HUTCHINS: Do you think your three percentage points of unconventional monetary policy left.

MR. BERNANKE: Yeah, yes, yes.

MR. HUTCHINS: Paul Krugman, is there anything you want to say?

MR. KRUGMAN: I'm not saying, I mean I hate to -- I mean, Ben knows more about this than anyone. But I've just been a skeptic. I mean, the fact, that we're still arguing about the effectiveness of QE after all these years, I think is a persuasive evidence that the evidence ain't that persuasive. (Laughter) And so, it seems dubious and let's also say we shouldn't have too much of a parochial U.S. perspective here. The other large advanced economy, the Eurozone, how much room do they have for that? And so, I think we, at a very large part of the world is already in pretty dire straits here. And we have no idea about the size the -- yes, 550 basis points has been the historic cut, but that was...

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...inadequate, in the last recession we have. We don't think we're going to have another shock, 2008 style shock coming but, of course, we didn't think that one was coming either. So, I think that we still have a very fundamental problem of just not -- we don't know that we don't have enough policy room under existing rules, but there's just seems to be a substantial probability that we don't have enough policy room and that ought to worry us a lot.

MR. HUTCHINS: And what about Europe and Japan? They don't have the luxury we have, right?

MR. KRUGMAN: No, I was saying that they're in much more difficult situation now, particularly, Japan. And this goes back to my initial comments about inflation expectations and being anchored, et cetera. One of the reasons to be aggressive about these policies, that if inflation expectations get anchored at a low level, then you're in serious trouble.

MR. HUTCHINS: Right, right.

MR. BERNANKE: And so the Japanese situation is quite different from the U.S. situation, fundamentally because of where inflation expectations are. Europe, inflation expectations are

too low, but not nearly as low as in Japan. And so I think there's some reasonable probability that they will eventually emerge from their current situation and achieve a more normal stance. But I don't disagree with Paul that Europe and Japan are much more difficult states and the Federal Reserve, number one.

I think that I'll say honestly having recently been thinking a lot about the evidence on QE for example, that your comment about, we're still arguing whether it's effective or not, that's kind of a median narrative. If you actually look at the research that the evidence is actually pretty strong that it is effective.

MR. HUTCHINS: Right. Olivier, I thought you were going to propose a higher inflation target. You've completely thrown me off my game by talking about now targeting wages. Have you surrendered on the idea that 2 percent inflation is never too low?

MR. BLANCHARD: Never.

MR. HUTCHINS: Okay, (Laughter) Just checking.

MR. BLANCHARD: No, no, but there is a timing issue which is that this was, I think it's still a completely reasonable proposal as a steady state solution. And that should be discussed as such. Now, announcing today 4 percent is basically, has zero credibility. They don't think it would help. So, it's probably not the time, but if you invite me in a few years.

MR. HUTCHINS: Okay. (Laughter)

MS. MESTER: Can I comment on that?

MR. HUTCHINS: Yeah, sure.

MS. MESTER: Because we have some research coming out of the Cleveland Fed that's pertinent to this. So, it's the argument that you raise the inflation rate to get more space seems very salient. It's hard to argue about it, but if firms are then going to be more flexible in their pricing and there's evidence that suggests higher steady state inflation means firms change their prices more often, it goes back to my original point, which means, that monetary policy will have to act even more aggressively to have the same impact. So, you don't get as much space as you might think in terms of when you move the --

MR. BLANCHARD: I think --

MS. MESTER: -- within a DSG model.

MR. BLANCHARD: I think you have it wrong, which is, I mean, suppose prices adjusted very fast. That in principle, things would be better. It would be less need for monetary policy, but basically --

MS. MESTER: But once you got into a downturn, you would have less space. So, for one -- in order to be able to get two percentage point of space, you'd have to be more aggressive on your policy actions. So, it's not, it's the transmission mechanism is effected because the prices are changing more flexibly.

MR. BLANCHARD: But again, the recession, according to the models we have, a recession would be less bad because prices would adjust faster.

MS. MESTER: Yeah, so --

MR. BLANCHARD: It's only your side thinking thinking. We can compromise there, right.

MR. KRUGMAN: Can I just, by the way, say that I'm going to disagree with Olivier, that maybe saying this is not the time to talk about it. And I agree. The bootstrapping, they just -- announcement (inaudible) I probably set this thing back by many decades by saying credibly promised to be irresponsible 20 years ago.

There's absolutely zero evidence that that works, so it wouldn't, but I think if we're thinking about laying the intellectual groundwork for what happens the next time things go really wrong, it might be a good idea to keep alive. The fact that the 2 percent inflation target, which has a very peculiar history, and was based on partly unjust happenstance; partly on assumptions that had turned out to be entirely wrong was not a good idea. And that comes the next global slump, we suddenly have a fiscally profligate Germany and President Bernie Sanders in the United States and all this stuff and we have a chance to have a combined fiscal monetary expansion that the idea that stopping at 2 percent inflation is not a good idea, would be a good thing to have out there.

MR. HUTCHINS: Okay. Loretta, let me ask you about another thing that people talk about. Some people basically say, "Yeah, we don't have much inflation, but -- and it's terrific to enjoy the fruits of a hot labor market, but we are sowing the seeds of the next disaster by not taking it into account enough, the financial stability risks that we run by running low interest rates for such a long time." Is that something to worry about or is that just something that people worry about who don't have nothing to



worry about something else?

MS. MESTER: So, I think what we've learned over the past several years is that we do have to take financial stability concerns into account when we're thinking about monetary policy. That's not to say to add it as a third mandate or whatever, but it is something that we have to take into account. And you have to recognize that if you're running very low interest rates that you may be creating some financial imbalances that may come back to haunt you in the future.

So, I think you have to sort of understand that those kinds of effects can occur. And, in fact, Nellie, when she was at the board, she developed a whole structure for allowing the FLMC to actually --

MR. HUTCHINS: Right.

MS. MESTER: -- examine those kinds of imbalances and actually monitor them.

MR. HUTCHINS: And how much of a worry would you say that is today?

MS. MESTER: I mean, there are some issues in terms of non-financial debt levels being high; commercial real estate pricing being high, but I think they're at moderate levels that we can handle them. But I think it is something that you have to think about partly because, in theory, we'd like to use macro-prudential tools to worry about financial imbalances and monetary policy to focus on our dual mandate goals. But in reality that's a hard thing to do because we don't really have that many macro-prudential tools --

MR. HUTCHINS: Yeah, it's a problem, yeah.

MS. MESTER: -- and the Fed recently did a tabletop exercise where we ran through scenarios. So, the financial stability committee within the Fed in the Conference of Presidents did this, we have a working paper out on our, in the Cleveland Fed website that sort of talks about the results of those, that tabletop. And it really is clear that when you get into a situation where financial instability issues come to play, we don't have many tools that we can actually use to address them.

MR. HUTCHINS: Hmm. Ben, there was some discussion earlier today about the importance of communications in setting inflation expectations. And you know, Michael Weber whoever made the case that you really do have to worry about household and firm inflation expectations and just influencing market participants and investors is inadequate. And he pointed out which I think something

we all know, it's hard to communicate this stuff to ordinary people, even the ones in the top half of the IQ distribution.

MR. BERNANKE: Why are you pointing at me? (Laughter)

MR. HUTCHINS: You're in the top, at least in the top decile banner. But no, I wasn't. Do you think it's important? Do we, does the Fed, do Central Banks have to worry so much about their ability to adjust consumer inflation expectations or can you get along way there by influencing the markets which definitely are influenced by the Fed?

MR. BERNANKE: Well, first say that I'm very happy about the desire of the Fed and other Central Banks to do more outreach and to talk to the broader public. The Fed listens series, for example, these are very important institutions. They need to be accountable, they need to be transparent. They need the public to understand what they're doing. There are limitations to that obviously, but I think it's really important to try to communicate broadly.

From a technical perspective, I think you do get a significant way there as long as the markets understand your goals. And maybe some of the pricing executives, the people who are in charge of the pricing in wage setting, I think that gets you a pretty long way. The Federal Reserve's FRB/US model actually has two settings. It has a setting called model consistent expectations where everybody is assumed to know what the Fed's target is and behaves accordingly. And then, model consistent asset pricing is the second setting whereby, only the bond market understands what doing.

And it turns out that you get two thirds or three quarters of the way there in the second scenario. So, I'm sure it's the case that a very large fraction of population does not know what the Federal Reserve is, much less what its rate is targeting. I think we need to, I think the Fed and other central banks would be well served by trying to increase literacy about these things. But I don't think that even some of these policies -- we'll be talking, I'm sure about price level targeting some of these types of policies that rely to some extent on forward looking behavior. I think that simulations and other analysis suggests that you get a good bit of benefit even if only a minority of the population understands exactly what you're trying to do.

MR. KRUGMAN: Just to say on demand, monetary policy works basically through housing and the exchange rate.

MR. HUTCHINS: Yeah.

MR. KRUGMAN: And So, if you can get to the minds of the people who set mortgage rates and people who set exchange rates, that's all that matters.

MR. HUTCHINS: I won't go quite that far, but --

MR. BLANCHARD: With respect to inflation, what methods is, I think the, the expectations, the financial expectations of firms to a large extent.

MR. HUTCHINS: Right.

MR. BLANCHARD: And it's criminal that we don't have a good survey --

MR. HUTCHINS: Criminal?

MR. BLANCHARD: -- of firms. Yes. I mean, that's absolutely needed because when we look at households, their expectations play a very minor role in the determination of wages. And the termination of wages, it's for firms --

MR. HUTCHINS: Right.

MR. BLANCHARD: -- it's the HR department. So, we should have the survey of HR department inflation expectations. This is a really important viable to know. And as far as I can tell, there is none in the U.S. and the New Zealand example, which I think was referred to by this morning, is not very convincing. I mean, I'm sure the people in HR department, us --

MR. HUTCHINS: Yeah.

MR. BLANCHARD: -- are more careful than the households.

MR. HUTCHINS: I wonder if before we turn to the audience, if Paul, Ben and Olivier could give Loretta some advice (Laughter) not about what to do with interest rates, but although that's always welcome. I'm sure that Loretta needs more opinions on what to do with interest rates. But the Fed is involved in this rethink of its monetary policy framework. It has already ruled out Olivier's raising the inflation target option. But briefly what is it that you think given all the things we've talked about today, what's happened with inflation; what we understand; what we don't understand; what is the right thing to do with the framework to put us in a better place than we are today? Do you want to start Paul?

MR. KRUGMAN: No. (Laughter) No. I have to admit I'm a little bit baffled to -- it feels to me as if the various things that we, that our understanding of the economic such that it is, just all seem to

be kind of impossible out of some combination of politics and institutional constraints. So, raising the inflation target, they're extremely persuasive, but apparently off the table. Wage targeting, is extremely persuasive. But I would say that it's off the table. So, I'm not at all sure. I'm not sure what the answer is. I'm supposed to be saying something helpful here, but I'm feeling like sometimes when you talked to developing countries and try to go through policy options and they say, well, that would be impossible unless we take a little off the constraints and there turns out to be no space.

MR. HUTCHINS: We could be there. Ben?

MR. BERNANKE: So, the Federal Reserve is talking about the so-called makeup policy approach. The idea being that if you fall short of inflation, your target for a period of time as you have recently there'd be some compensation for that and the debate about that has turned on technicalities and would it be credible, et cetera. I think they're relatively simple variants of that are qualitatively possible. It could be explained qualitatively that we'd get a lot of the benefit. So, for example, the technical variants, I've proposed this thing called temporary price level targeting, whereby, you get to zero lower bound and you fall short of the target. You compensate for that to some extent.

That the version of that which seems to work pretty well is called temporary price level targeting with a one-year look back. In other words, you only keep rates to zero until you've established over a year that you can hit the target. And what that -- what you can explain that qualitatively is saying that when we're leaving from zero lower bound, we want to be sure that we have established robust, like the European central bank talked about robustly converging to the target. We don't want to start a process of normalizing rates until we have clearly established that we can meet to target.

That over a year that would be a fairly simple explanation. It would be one that would have most of the benefit because the bond market would appreciate it. The Fed would be very slow at beginning to raise rates from a zero lower bound situation. And it doesn't involve complex price level targeting calculations and things of that sort. So, I think -- that's just an example. I think that the makeup policy approach, can be done within the context of the current inflation target, but simply defining what it means to hit the target.

And in particular, that hitting the target just momentarily is not enough. That we want to establish that we are sustainably at the target and simply doing that would have some of the makeup

qualities that these optimal, theoretical approaches have and would not involve any major change. I don't think you would create any particular political scrutiny or any particular confusion. So, that would be my, that'd be my suggestion.

MR. HUTCHINS: Olivier?

MR. BLANCHARD: So, I think that we're flirting with the world of (inaudible) stagnation to different degrees. Here with flirting. In Europe, we have married at, right. (Laughter) And so, in that world, much we pause is going to be very constrained and we see it in Japan, we see it in Europe. I totally support what Ben is pushing, but I suspect it's very second order relative to the size of the task. And so, that maybe you're going to be able to predict what I'm going to say. What about fiscal policy? It seems to me that fiscal policy in the same context is needed. It's cheap, and --

MR. HUTCHINS: Because rates are so low.

MR. BLANCHARD: Yeah. And rate, yes, the cost of debt is very low and it can be used infinitely better. In the U.S., unfortunately, I have no doubt that our President and our Congress will use it. Probably not right, but will use it. But in Europe, clearly the issue is to convince governments to do it. But it seems to me the solution is not to try to do some more twist on money, which I think we have to, but not hope that that's going to be the solution. The solution is to have a more expansionary fiscal policy.

MR. HUTCHINS: Loretta, do you want to weigh in on this?

MS. MESTER: Well, just the way you think about inflation expectations needing to be well anchored to allow monetary policy to kind of rack negative shocks. I think for the fiscal policy, same thing. Like if we had fiscal policy on a sustainable path, then you would be able to use it in the way that we'd like to be able to use it as counter supportive, highly. I think the same issue. I think just like we need to make sure that we're running monetary policy to keep inflation expectations anchored so that it allows us to use monetary policy more effectively. I think the same thing with the fiscal side. And so we are in a sort of a dilemma here.

MR. HUTCHINS: We have time for some questions. Again, raise your hand, stand up, tell us who you are and be as brief as possible. There's the one here, Helen, or -- and I'm going to take three and then we'll see where go from there.

MS. GOUL: So, this is for the whole panel.

MR. HUTCHINS: Tell us who you are?

MS. GOUL: Grace Goul. This is for the whole panel. So, do you see your future of much small coordinated monetary and fiscal policy? And what would be monetary policy like in that region? Thank you.

MR. HUTCHINS: Thank you. Jared Bernstein over here.

MR. BERNSTEIN: Instead of -- oh, sorry, Jared Bernstein. Instead of targeting, wage growth, how about targeting labor share? Because there are times when you want unit labor costs to be rising in order to rebalance factor shares that get whacked in a downturn as we've seen.

MR. HUTCHINS: And why don't you pass it behind you.

MR. MATTEI: Thanks very much. Matthias Mattei. I teach political economy at SYS across the street. And my question I guess is for the current and former central bankers mainly. I can't think of a decade where central bankers have been so attacked by politicians like, Mark Carney by Brexiteers, our current central banker by the President, Mario Draghi by German politicians. Is that something you actively worry about that this is going to get worse? Is this something that's going to go away if we get back to more normal times of monetary policy and is this affecting how people think about the then the credibility and the need for Central Bank independence? Thank you.

MR. HUTCHINS: So, let's start with the coordination of fiscal monetary policy. Is that likely and what does it look like?

MR. BERNANKE: Yeah, I learned everything from Krugman about this and Krugman taught me that it only works if inflation expectations go up, right, if the monetary -- so, as long as the inflation target is credible, then you might as well just do the fiscal policy and have monetary policy sort of agree to be supportive in some way.

MR. KRUGMAN: Yeah. So, that's right. Yeah, there would be a -- there's this idealize by the -- I'll call it the Blanchard 4 percent inflation target. Although that's me too. But anyway, the -- so, we have a coordinated fiscal expansion to get you to that point with which is ratified by monetary. That doesn't seem to be on the table anywhere. And then if we talk about actual coordination that might happen. I actually worry a lot about who's coordinating with whom. So, I would be perfectly happy with Mario Draghi getting to set German fiscal policy. I'm not a very happy with the German government

getting to set ECB policy. (Laughter)

MR. HUTCHINS: Olivier?

MR. BLANCHARD: Yeah. I think that two dimensions of coordination, there is within a country, fiscal and money. I think that that can be done in very simple coordination and you do something, you tell a fiscal authority, you do something. And I just head to a bank, I'll react to it and make sure that I am undo the effect on output, if it's a negative. I don't feel it implies no more than just that.

Clinton-Greenspan is an example of that. I think in coordination, we cross fiscal policies, across policies across countries. That's a much more difficult issue in the Eurozone. And there again, I think that if the Euro zone goes for recession, the uncoordinated fiscal response will be too weak because when Belgian expands, it doesn't get much of a reward. (Laughter) So, there I think there is a need for coordination whether it happens or not, it should. It probably will not, would be my answer.

MR. HUTCHINS: Loretta, when the question was asked about central bankers being attacked, which is, of course, true, I had this image that Paul Volcker would storm into the room and say like, "You guys don't know what to be attacked is," (Laughter) but --

MS. MESTER: Exactly.

MR. HUTCHINS: I think there is an attack on Central Banks around the world and, of course, on other institutions as well, and I think he was wondering how do you cope with that as a central banker who doesn't seem like an evil person, at least from my conversations with him.

MS. MESTER: Thanks, I'll take that long. I feel like I'm privileged to work at the Federal Reserve. I feel it's a very honorable institution. I've met and worked with people like Ben and I can just tell you, everyone is sort of focused on making sure that our policy is the best policy we can to hit our goals. There are going to be challenges thrown in your face. One of them may be the criticisms we're getting in this act, this environment. But it's part of the job that you just to have to kind of stick to the knitting and make sure that you're doing your policy the best you can. And there is no simple answer on policy. That's why you see sort of the discussions that we're having in terms of what's the way to go about doing it; what's the right policy.

So, you have to deal with that. I do have concern that we get this question all the time. And if you've been in FLMC meetings, you know these considerations never enter the room in terms of

our policy setting, but the fact that we're getting asked these questions do make you have to be taken to account that there are people out there who may not know that, right. These considerations are not affecting our policy. And so, I do have concerns about that. So --

MR. HUTCHINS: And on Jared's question about targeting labor share instead of --

MR. BERNSTEIN: I think it's a very different, animal I was targeting nominal wage growth, real wage growth, labor share is much more real viable. So, I will not touch it.

MR. HUTCHINS: I'm reminded of a, there's a great, on of Bernanke's great lines in the transcripts is when the Bureau of Economic Analysis revises GDP growth for a number of years for Bernanke says, "Well, if they can revise GDP retroactively, can we do the same thing with interest rates?" (Laughter)

I'll take two more. Bert Elli in the back and then this gentleman over here. And then we'll have to call it a day.

MR. ELLI: Bert Elli, a banking consultant. It was a reference to a fiscal policy and a coordination with monetary policy. How realistic is that in the United States today given the very substantial deficits that were running and a rapidly rising ratio of federal debt to GDP, another way to put it is fiscal policy is a response to a downturn really off the table, given how, significant the federal deficit is during a full employment economy?

MR. HUTCHINS: Thanks. And there's one -- the gentlemen there. Thank you.

MR. DETMEISTER: Alan Detmeister, UBS. President Mester, you mentioned an inflation band. So, how wide would that band have to be standard deviation of core; PC inflation's roughly four tenths a year. Katya showed in her charts that a core PC over the last 20 years has been around 1.7. We're currently running 1.8. Is monetary policy precise enough to be able to push up inflation a quarter percentage point?

MR. HUTCHINS: Okay. Why don't you take that one and then we'll let --

MS. MESTER: Okay, I just think as a communication device, we know inflation's going to vary for various reasons. I think as a communication device, having a band makes sense. It also allows you to allow you to have some scope to run inflation a bit higher in the band during good times. And then when you go lower, go into sort of getting closer to the zero lower bound inflation will be below the 2



percent. So, it gives you more slowly and more flexible.

MR. HUTCHINS: So, like what, one percentage point?

MS. MESTER: It could be or, I mean that's not a bad target. Just thinking about sort of how you'd want it run, sort of higher in normal times and maybe less high in more downturns.

MR. BERNANKE: Yeah. I somehow this relevant to the coordination, I somehow forgot to mention one place where you really have had coordinated fiscal and monetary policy is Japan; IBM, Kuroda, basically, and then in some respects the outcome has been disappointing. But one thing that has certainly not been a problem is people losing confidence in the ability of the Japanese government to repay its debt. And Japan is far deeper in debt and has far worse long-term demographics in the United States.

So, the notion that the United States is anywhere close to Olivier's has documented this a, the idea that we're anywhere close to the limits of fiscal policy just seems to be utterly at odds with all the evidence.

MR. HUTCHINS: You agree with that?

MR. BLANCHARD: Yeah. There's no justification for doing something crazy, (Laughter) but --

MR. HUTCHINS: Good to know. All right, this could go on for a long time and I really want to thank all the presenters and because we had a pretty good group of people and I want to thank my colleagues who helped organize this and thank all of you for the good questions. If you could do me one more favor on your way out, if there's papers or coffee cups at the back of your room, there's a trashcan in that corner. We'd appreciate that. And please join me in thanking everyone. (Applause)

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