

Transcript of Conversation with Alberto F. Cavallo (Edgerley Family Associate Professor of Business Administration, Harvard Business School), Harrison Hong (John R. Eckel, Jr. Professor of Financial Economics and Executive Director, Program for Economic Research, Columbia University), Sophia Johnson (Assistant Director, Program for Economic Research, Columbia University), Yves Lemperiere (Head of Predictor Research, Alpha for Capital Fund Management), José A. Scheinkman (Charles and Lynn Zhang Professor of Economics, Columbia University), and Michael Woodford (John Bates Clark Professor of Political Economy, Columbia University).

Wednesday, January 27, 2021

Harrison Hong:

Good morning I'm Harrison Hong, Professor of Economics at Columbia University. In 2019, Columbia University's program for Economic Research and Capital Fund Management

launched an initiative to explore and analyze how alternative data can be used to further the understanding of financial markets, improve economic forecasting, and enhance investment strategies. Through a series of seminars and workshops, this initiative focuses on understanding how alternative data can be used to better understand price formation, by looking at a range of non traditional data sets that have yet to be fully analyzed.

Today, we welcome Professor Alberto Cavallo of Harvard Business School to speak on the role of alternative data in measuring inflation. The topic couldn't be more timely given concerns regarding inflation at the moment by in global economies. Just this morning I woke up to report on Axios of a poll by civic science that says that 42% of Americans reported being very concerned about inflation and this number jumps to 77% for those who think that COVID-19 will only last a couple more months.

Before we - after Alberto's talk - that's going to be followed by a panel discussion with Professor Mike Woodford of Columbia, Professor José Scheinkman of Columbia, and Yves Lemperiere of CFM. And, before I introduce Alberto, let me introduce Adam Rej of CFM to say a few words about our initiative before we get started. Adam?

Adam Rej:

Thank you Harrison, and hello everyone. The CFM-PER Alternative Data Initiative has been launched because of how important alternative data has become in investing and in economics. The joint initiative enables Ph.D. students to use alternative data sets in their research projects and provides a platform for cross collaboration of academics and investment professionals. While many of the alternative data sources are novel and previously unexplored, it is important to maintain the same high standards of academic rigor when assessing their usefulness and explaining stock market and economic phenomena. Currently CFM is hosting two groups of students and our projects are due to be completed by July this year.

Also, as a part of the CFM-PER Alternative Data Initiative, we periodically organize seminars, such as this one, on data sets and research that seemed particularly timely. And today's edition is

dedicated to innovative work done by Alberto Cavallo on real time inflation measurements. Without further ado, let's learn something new. Thank you and over to you, Harrison.

Harrison:

Thanks, Adam. Alright, our speaker today Alberto Cavallo is the Edgerley Family Associate Professor of Business Administration at Harvard Business School. He's a faculty research fellow at the National Bureau of Economic Research and a member of the Technical Advisory Committee of the U.S. Bureau of Labor Statistics, BLS. Alberto co-founded the Billion Prices Project, an academic initiative to pioneer the use of online data to conduct research on high-frequency price dynamics and inflation measurement. He received a Ph.D. from Harvard University in 2010 and MBA from MIT Sloan in 2005 and his Bachelor's from the University San Andreas in Argentina in 2000. Alberto, welcome, and thank you so much for joining us, the floor is yours.

Alberto Cavallo:

Thank you so much, it's really a pleasure to be here. Let me thank the organizers I'm really humbled and honored to be presenting at this seminar. When I was invited, I was told that the intention of this seminar series is to expose Ph.D. students to alternative data sources and how they can be used for academic work. So I prepared a presentation where I'm going to tell you the story of how I got started with this when I was a Ph.D. student. Hopefully, it will give you ideas of what you can also do and encourage you to collect your own data in some ways. Towards the end of the presentation, I'll focus more on how this could be used for forecasting - or the perspective I'd take on it is how we can improve high-frequency measurement of inflation, which is a topic, as was mentioned, is worrying, a lot of people, these days.

So, let me start sharing my screen first, and then I'll walk you through first the motivation on these alternative data sources in the fields I work in, which are microeconomics and international economics. And you probably heard a - you know - I'm quoting here a couple of articles written by prominent economists in recent years, emphasizing some of the issues that macro data tends to have and also the need for an improvement. And these were goals that became quite common after the global financial crisis, but it's not really an old - a new story, I should say. When I was a Ph.D. student, I came across this great quote by Griliches, the famous economic researcher. who had helped statistical agencies so much in developing, for example, the methodology for the hedonic adjustments of quality in the pricing. And Griliches ingredients wrote this paper back in 1985 and he made similar remarks, when he was President of the AEA, and he sort of, I argue, that as economists in academics, in general, we had shown little interest in helping improve the data itself. He has this phrase of "getting involved in the grubby task of designing and collecting original data sets of our own." And he pointed out that the issue is that most of the times we work with this, they found a that others have collected and we sort of make them responsible for all their imperfections. So he was making a goal for macroeconomics and, you know, other types of economists as well to go out and collect their own data. Now, the problem was that traditionally and back then in particular, collecting the type of data we needed for things like inflation or GDP was impossible. You needed a certain amount of resources that only governments had access to. And this is where, fortunately I think, the all these big data revolution that we have been seeing in the last decade or so can help. I, in particular, emphasize always that I think, you know, people tend to focus a lot on the

size of the data, but I emphasize the fact that it has opened up the possibility of others collecting data in ways we couldn't before. It doesn't have to be a government, it can be you know even a Ph.D. student working with a laptop today is able to construct very interesting data sets that can be useful for research, but also for policymaking. So, you've probably been exposed in previous events of the series to some of these data sources that I'm listing. They have become available in recent years, as part of this alternative data world. You know things like more administrative data governments have, scanner data that companies like Nielsen collect, that grocery stores [collect], there's a ton of data on search satellite and sensors. Now I mostly focused and worked on the last two that you see here - crowdsource data with mobile phones, but mostly with online data, which is the one I'm going to describe today.

And as Harrison was saying, we started this project called the Billion Prices Project about 11 years ago to try to see how these could be used for research and measurement purposes. But I'll start there with the story of the origin, which is quite fun actually and illustrates some of the potential advantages of these by making a connection to these five Vs of big data that you probably have heard about. So I'm going to use some fancier slides that I used in another presentation. But you probably heard that big data is often described as having you know a lot of volume, a lot of velocity, variety, and lately, people are adding the last two that you see at the end. It's helpful to understand when whenever we have uncertainty about data to have alternatives data sources and also there's potential value that people are trying to extract for business. But I'm gonna- the origin of our story with the Billion Prices Project was around this idea of veracity - knowing what was really going on behind the scenes, in my country, where I'm from- Argentina. So I'll tell you a story of how that evolved. Now, many of you may know already Argentina has a long history of inflation and you know we experienced the hyperinflation in the late 80s. Then we had a relatively stable period in the 90s, but, in the early 2000s, inflation started to rise again. So what I'm going to show you here are the statistics of the annual inflation rate. Towards 2000 for the level was relatively low, but as we approach 2006 the inflation rates that started to rise because the government was having these, a fairly expansionary monetary policy. And when we went over 10% it became part of the political discussion, it was like a psychological barrier, a lot of Argentina started getting worried, so the government started getting concerned and, of course, they could have acted the - you know - more responsibly, if you will, it tried to cool down the economy. But that is not good for both so they decided to try different strategy, they started calling the statistical agency and trying to figure out. who were there retailers that were being sampled in the- in the survey, so that they could go and talk to them and somehow prevent them from raising prices. To which, they statistically, used to say no, no, this is something that is impossible, we have a law that says that this information is secret. So they started fighting with the statisticians. The inflation rate in those months sort of stabilized around that level and, eventually, it appeared the government good a bit frustrated and decided to fire everyone at this at this statistical agency to intervene, the office, and then replace that the long-standing statisticians there. Argentina, had a very credible and respectable statistical agency at the time. And then, magically the inflation started go down, you went below 10% and sort of stabilized.

Now, if you have ever lived in a high inflation country, you probably realized that when you go to the supermarket you sort of realize you feel that inflation is quite high., something that the surveys of inflation expectations were picking up. So I'm what I'm showing you here is the results from a survey of perceived inflation or inflation expectations that the University was conducting, and when

it turns out, when you ask people how much you think you please and really is a lot of them were coming out with numbers that were much higher. There was no way of knowing to what extent this was true or, you know, some people may have been reading the newspapers that the Statistical Office have been intervene so maybe they were assuming inflation was higher, but I was a Ph.D. student back then, and I was getting involved with all the micro price data literature, you know, there was a literature on price stickiness and we were trying to produce some stylus facts and I realized that there was a way to collect data online through the websites of retailers. Now, there were many retailers at the time showing their prices online in Argentina, but most of the most important supermarkets were. And the nice thing about this is that all the information was basically there on the website, you had all these details about the products, their prices, you can sample them on a high frequency raises on even a daily basis, potentially, and I had you know the luxury being a Ph.D. student back then, so I had a ton of time to dedicate to figuring out how this could be done. Now, it turns out that every page we see has a very structured language behind it. The HTML code. And you know you can teach a software to identify certain pieces of these codes that tell you where a product description lies, or where the brand lies, or where the price lies on the page and as long as they didn't change this look and feel I realized, I could use these techniques that were in fact, by the way, I should say be available in the computer science world for monitoring prices across different retailers was widely being was finally being used outside academia, so I realized, I could use these techniques and start building my own data sets on alternative sources to see if I could measure inflation. And the goal was to apply exactly the same mythologies that the statistical agency was applying, but with different source of data. I built the splicing they said you're looking at here for Argentina. It's normalized to 100 when I started collecting data in 2007. And you can see, in the course of basically four years the official index had increased by about 27-28%, whereas the online index suggested that prices that actually doubled during that period of time, so it became quite obvious, when I looked at this picture that the online inflation was much higher, but it wasn't clear to what extent these was me, in the you know, the technology I was supplying rather than the government lying.

So I went - this is a graph from one of the papers of my thesis. This was one of the most fun papers to write because I was trying to try to detect what the Argentinian government was doing. And the first thing I had to do is show that it was not the online data that was wrong, so I went out and collected similar data in Brazil, Chile, Colombia, and Venezuela - countries with very different inflation levels. Venezuela, by the time, had like a 30% inflation rate, so it was more similar. Then you can see from the simple graphs there are obviously some temporary differences, but the trends are actually quite similar by applying very simple techniques and no special adjustments at all this is data was coming straight from this supermarket, so I was sure it wasn't the online data by itself that was going on here in Argentina. In fact, this slide shows you what happens when you compute the annual inflation rates and the only outlier here is Argentina. Venezuela, it's interesting, at the time, Chavez was not trying to hide the inflation rate. In fact, he was openly showing that inflation was high and using it as an excuse to sort of go after some companies and retailers that he wanted to expropriate. But it was a very different strategy. There's a theory it was doing something to the statistics, and I had to try to show why.

So, I started experimenting in different ways. I used different retailers that you see in those graphs. Now we're looking at the annual inflation rates that, in my numbers, were between two to three times higher than the official index. And you're seeing here different lines that show you what

happened if you use, you know retailers that targeted reach, retailers that targeted poor people and the results were always a very similar. I also tried to see if they were using the data from only from price-controlled goods which the government was trying to impose at the time, and that's the dotted line you see here, it was sort of more volatile because there were periods, where you inflation some was lower but then it jumped back up as soon as the controls were lifted. And I was always getting these higher numbers now and then. I just kept looking at this graph and realized that the 200 inflation rates can move very closely over time and if you think about it - if you are going to lie about a statistic, you need to at least be dynamically consistent. So, there's a period here in 2009 when Argentina was in a recession, because of the whole world was experiencing a crisis. So, if the government said before the inflation rate was 'A', they had to actually show a decline towards 2009 so if there was sort of a natural movement in these lines. And after trying many things, I decided to test a very simple algorithm which is simply dividing by three. And if you do that, it turns out, you get a very close approximation to what the actual inflation rate that they were showing was. My thinking here is that if you think about it when you're if you're the government to trying to lie about the statistics you have two ways of doing it. You can convince everyone who's doing the data collection to lie with you, which is hard to do, or you can let them do their job, they collect the data and the someone at the end who is actually aggregating the numbers and that person can apply whatever, you know, adjustment he or she wants.

They could probably have picked a better algorithm than dividing by three, but in any case, this was seemed to be a close approximation to what they were actually doing, and this became sort of common knowledge. People realize this was going on. By the way, if you lie about inflation, as many of you know, that will affect many other statistics such as the growth rate, so in the paper, I showed that using these new inflation estimates, you'll get much lower rates of growth for Argentina during those years. It's easy to show, in fact, if you look at other alternative matrix of inflation data, for example, the CPI and the GDP deflator, were co-moving very closely in the past, when the manipulation of the index started, you start seeing that divergence because the CPI was being manipulated, but not so much the deflator, for other reasons. You know those are very interesting, this kind of thing, you can use benchmarks [inaudible], lots of stuff but it became quite obvious that this was a disaster in terms of the information that Argentina was publishing. Now the other thing I did is beside write the paper, is I put up this website that would show the price of all the things on every single day, I will calculate the increase in you know, each individual goal that I would show the information there in sort of real time and I'm showing you this because I found when I was getting involved in this a world of alternative data that in collecting my own data, that it was extremely useful to try to make whatever data collection, I was conducting operational in a way, and make sure it was running all the time, particularly if the time series is going to be important for you, even if you don't make that information public. Just going through this experience of trying to produce the statistics continuously allows you to understand much better which things can fail, what things are important to control for, and that sort of thing. So even if you are, if any of you decides to do this kind of work, I encourage you to try to do a - compute this on a continuous basis as frequently as possible.

Here a few slides that tell you what happened with Argentina, just to end with this. There's a quote from La Nacion, which is our major newspaper in Argentina, already reflecting in 2008 that the vast majority of Argentines knew that the statistical agencies' numbers were grossly manipulated. Then in

2012, The Economist magazine decided to drop Argentina's official numbers and they started using our data. And then finally in 2013 the IMF issued a declaration of censure, which basically was like saying a to Argentina that they were aware and that the data was being manipulated and was urging the government to correct the inaccuracy. Now, one thing I found sort of surprising in all of this is simply how long it took for the government to actually make something about it. Once the government starts lying, it's very hard for them to get out of this lie. The government's stated inflation until 2016, and you can see there, the annual inflation rate was consistently much higher than what the official numbers were suggesting then eventually there was a change in government. And things change, you can see, after 2017-18, the numbers start coinciding very closely, which is a way to validate the source of data in Argentina. There's a gap here in the data, you can see that's because, when the new government went into Argentina, they actually could not in the physical office, they could not find the hard drives where the data was to have been stored. Somebody had pulled them out and destroyed them. So they had to really, you know, redesigning everything from the data collection process. But anyway, eventually Argentina told the truth, and I should say I've done this in other countries, I've never find the reasons that these happens. In a way, I think, because we now live in a world where this type of manipulation is becoming very easy to detect.

But let me move on to what happened next. We decided to start with, my advisor, Roderigo Rigobon, on this project called the Billion Prices Project, where we said we can try to collect this type of information and use this data not only for measurement, but also for our own research. That was created in 2008, I started working with a lot of undergrads at MIT, showing them how I was collecting data and getting them to help me expand this. We eventually we're covering about 60 countries, and the idea was to replicate what I had done in Argentina. We were using the scraping technology connecting to hundreds of retailers on a daily basis, getting this individual information and then use it to build some statistics. If you think of this as an alternative data source, like any data source, it has advantages and disadvantages. So this is a table from a paper we published in 2016 comparing to scanner data and CPI data. And on the top, you see online data has these advantages which are quite obvious, the cost of collecting each data point is much lower, we get them very quickly. We can see all the products that the retailer sells on the website at one point in time. We get this uncensored price spells, because you know if there's a new good that is sold today, that will get captured by this technique. Whereas, the statistical agency would usually just incorporate new goods when an old good disappears and create some [inaudible]. For international work, it just immediately gave us data from a lot of countries that was comparable. But they're also I should say some disadvantages. The number of product figures that we can cover with online data is relatively few. Particularly services is something we cannot get good data, historically, we cannot good data. It's getting better because more and more services are appearing online. I think, in a few years, this won't be a problem. The number of retailers in companies covered, we obviously have to, we can collect data from the ones that are there. Usually large multi-channel retailers or online only retailers, but there are a lot of retailers that were not online, particularly at the beginning. Again, this is something that is improving. The one thing we also do not get - and I don't see any perspective for this improving, at least in the short run - is the fact that we see prices, but we do not see quantities with the [inaudible] expenditure weights. So we have to get those from other sources. And I mention this just to emphasize, there are many advantages in online data, but you have to combine it with other sources which also have their own specific value for each question that you may face.

Now, as I said, this became a large research project. I've listed here all the papers, I read them with this data. I would love for you to read all of them, of course, I know that it's impossible, but I'm using this simply to show you how this data can be used for different topics. Let's say in macro international. Obviously, I'm going to talk today about inflation measurement and how that can be done in high frequency, but you can think of using it to understand how one-line pricing works, price discrimination may work, obtain stylus facts for price stickiness. And also, even you know written papers on inflation expectations to see how people react to information on individual prices. And on the international economics front, if any of you are interested in issues about passthrough or testing theories of international pricing, LLPs, purchasing power, all that information is things you can do with this data we couldn't do with older data sources before.

But let me focus on inflation measurement percent and tell you how this evolved and how it can be used for forecasting purposes. So here is a little bit of the timeline. In 2008, I started publishing this daily index for Argentina. And then, a couple of years later, we started showing some statistics for the US at a time where inflation was rebounding like it's doing right now. On the website, which got a lot of attention, then eventually the project became so large that we need to find alternative way to fund such a large collection.

in 2011 we started producing a - we created a company called PriceStats that to this day, collects all these micro data and has been publishing since 2011 daily inflation indices in 23 countries. And this is done in real time, or almost real time, there's only a three-day lag. This information is produced and published. The company also produces some PPP statistics, which you can think of them has been very large-scale big MAC indices, where instead of just having the big MAC you're putting, you know, coffee, lots of other goods, identical goods across countries, which can be useful for purposes of understanding the value of exchange rates and the dynamics for exchange. But I'll focus on inflation measurement, this is the index we're mostly known for. This is essentially an online index created with the same methodology, I was using in my paper in Argentina, but for the US. It has been produced continuously since 2011. The two lines that you see, there are the online index in red and the headline CPI which looks like the step function because that's a monthly index over time. Now the reason this has proved to be quite useful - to understand inflation in the US, not only that the two lines to move so closely together, but also, if you look at it closely, there are many times, where the online index seems to adjust sooner than the CPI. So there's some anticipation in online prices.

We made that point clear, if you zoom in specifically to the beginning of our data, you can see that happening in the bankruptcy of Lehman Brothers, which I'm illustrating here in this graph, it's like a zoom of the previous version. Then you can see there's a there's the online index is the one that you have here in solid - the black. There's a date here, September 16 of 2008, that's the day Lehman Brothers goes bankrupt. Immediately we saw these large retailers starting to discount their goods, they knew a recession was coming, the crisis was getting worse, so they immediately started slashing their prices and the online index started to fall very quickly. Whereas the CPI took over a month, you know, it takes a couple of months, and then there's a publication like to actually show this decline. And then, by the way, by December the pricing next online have started to turn and you can see happening in the CPI until a couple months later, with the numbers for January were finally

published. So from a perspective of trying to understand what's really going on at a particular point in time, they started to prove quite useful and it's a type of use that we see even to this day.

So what I'm doing here is I'm showing you the last a six, sorry, about a year of data of the same index. And again, you can see, the co-movement within the CPI and the online index, but there are turning points. For example, in early March of 2020, we started seeing prices decline and the CPI reflected that with a lag, again, that took a couple of months to fully reflected the extents of the decline. And then again towards the middle of April, the index has started to go up again and the CPI took a while to sort of start reflecting that trend. And by the way, there's something else happening right now, which is making all this discussion about inflation very interesting. Since the end of November, basically after Thanksgiving, we have been detecting a much higher trend of inflation in online data and what you see in the CPI. Now given the history of these indices, I expect the CPI to start catching up to these trends. It has already started doing that, but in the next few months, you may see those converging.

I should point out, this is not the so-called base effects that are being discussed a lot in the media. This idea, as we get back to April, the annual inflation rate will mechanically start adjusting because we won't be experiencing the big declines. We saw in April and in May, this is a price index so those are not affecting these. These are actually showing that the level of inflation we've been detecting in the last three months online is actually above what is normal for these months. So it will be in addition to those base effects that inflation will start rising.

Now, can these be used for forecasting? Well the ability to detect turning points is clearly useful for that, so I have a couple of my students, Manuel Bertolotto and Diego Aparicio, have done work on this and they've basically shown that if you take these high frequency in this index in you plug it into a forecasting model, a pretty standard model, you know that uses like CPI and gas prices and other sorts of real time sources, which is the type of models that a lot of forecasters use, you can actually improve a lot their predictive power, particularly within one or two months. And the reason for that is pretty intuitive: one is that you have this high frequency of the data, you can observe prices on a daily basis, so you know what's going on even before the month and the other one is just the ability to publish and obtain that data quite quickly. So when I talk here [inaudible] the publication.

But more into my more importantly for me from an intuitive perspective, what I think this is particularly useful for- if you can measure things in real time, you can provide information during these times of crisis or economic turning points. When a traditional forecasting model that is simply using lat CPI or low frequency data will not work, so, in other words in a typical month, forecasts that use, you know take advantage of the persistence of inflation in the CPI, will actually do a good job of predicting what the number will be, but when you get hit by a crisis that changes things, you need some sort of live information on what is going on. And this type of indices, what they do is they tell you what these large companies are doing with their prices in its title information, you cannot get from other sources, so that when those turning points those shocks or crisis, if you will, is specifically when having these alternative sources is important.

So, as I sort of summarize here this measurement in real time certainly helps now past the present. But I emphasize it's only one or two months ahead, see we started thinking further down the line in. Then we need something else and that's where I focus my research on. I think, to be able to



understand what will happen with inflation more long term, we really need to understand the type of shocks we're facing and what is driving inflation dynamics. So, I'll spend some minutes telling you and using the sort of my research in this area to illustrate how we can understand some of the things that are happening right now with COVID.

In particular, these two events, one is why did we experience a decline that by the standards, you know, historically, this was a really mild decline or mild disinflation. Particularly given the collapse, we saw in the first or second quarter of the year in demand in output. And then what lessons can we learn over what's going on right here, around this time and what may be driving that? So I'll make a series of points.

First, when you look back at what happened here, one of the things I realized quite quickly is that the CPI itself could it be having a measurement bias. The COVID shock was unique in that sense, because what it did, is it dramatically altered our consumption basket, all of us, we were stuck at home, and we were certainly consuming a lot less of transportation, fuel, a lot more in terms of food. And you know, we have the advantage here, I'm not using online prices, but I have the advantage of getting alternative data from another project called Opportunity Insights that many of you, I'm sure, have heard about. Down here at Harvard and Brown University. And what they did is they managed to get data from credit and debit card transactions and produce indices that tell you how much people are spending in each one of these categories that you see listed here over time, relative to pandemic levels. And what these numbers are showing is that there was this huge collapsing of spending at the beginning of the pandemic and then a gradual recovery. Mostly in the figure is like health care and apparel and transportation, but the categories that have to do with travel, for example, remained very low, and this is very important for the purposes of measuring inflation during the crisis, because the CPI is constructed, as many of you know, with a fixed basket of weights for these different categories that gets updated in the best of cases once a year. The US is one of the countries that have done these more often. But the last time they were updated was in December 2019. So during this time, the CPI was using a basket, that was not really representative of what people were actually experiencing. So, if you take these changes in spending patterns and you adapt the CPI basket you actually get a COVID CPI inflation index that shows the inflation, it was actually much, much higher across the US. About 50 basis points and towards the end of the year, much closer to 2% traditional target. That, then, that the Fed has. And, obviously, there is a temporary bias, but I bring it up, because if you're interested in forecasting inflation, there's a lot of discussion and Harrison mentioned these a lot of Americans who feel that inflation is higher or are worried about the inflation. They have certainly experienced more inflation, all of us have done what the official statistics have done. So, even if it's a temporary bias, for, with topics that have to do with inflation expectations and how anchored they are, I think it's important for us to recognize that there has been more inflation than the official statistics person...

But there are other resources that COVID matters, looking forward. One is that it has shifted a lot of our purchases online. And a couple of years ago, I wrote a paper that tried to show why is it that online prices tend to anticipate what we see later in the CPI. And what I found in that work was that online prices tend to react faster so some aggregate shows, to the extent that COVID is moving us online it's a bit worrisome because whatever shocks these retailers are going to experience moving on you managing their costs continue to go up. Then we're likely to see that passed on quite quickly

into retail prices. The logic for these, let me spend a few seconds on that, is actually quite straightforward. When you go to the online world there's a lot more frequent price changes. In part, this could be driven by the fact that many online retailers use pricing algorithms that automatically adjust to the data they are collecting and even those that do not do that, they're monitoring their competitors very closely. So, you see the frequency of pricing changes increasing dramatically. And in the paper, I actually show that, historically, since we started collecting data for these large multi-channel retailers over time, the frequency of pricing changes had increased dramatically. You know, to give you a sense of these numbers, at the beginning of our data collection, the implied duration for a given price was about the nine or ten months. By the end of the sample in 2018, we were talking about three to four months. So it had dramatically altered the frequency of adjustment within these large companies that had to suddenly compete with these online retailers. And the other thing that the online pricing has - there's a lot of uniformity in pricing. So 30 years ago, Walmart could have different pricing in San Francisco than in Boston, nobody could even know about these. But the online world actually introduces a lot of transparency and people can see those changes. And they react negatively. It's what my late colleague in Julio Rotenberg would have called a fairness concern. And you know many of us do not feel it's fair if they charge us a different price online or offline or across different locations, so you end up with these large companies having this geographical uniformity in their prices. Which means that they end up reacting, not to local shops, but the more aggregate type of events.

So you put those two things together, you get more cost faster, which is one of the things I showed in that paper. In particular, when you look at gas prices and exchange rates, the level of pass through has actually increased over time. So, this is a worrisome outcome for the move to online purchases from the perspective of inflation. I will see the other some reasons to be more optimistic in that, you know, we wrote that paper, together with some colleagues last year on the trade war. And trying to see how quick the pass through of the trade war was and these additional tariffs. And what we found is that at the retail level the pass through was actually quite slow as long as the retailers felt that the shock was going to be temporary or they found other ways to have that. So COVID, is something that many I believe many companies may have felt at the beginning to be a temporary type of shock that prevented some of the initial pass through. And unfortunately, COVID is not type of crisis that you can find easily other ways to adapt, so that would be more problematic.

But just to finish with these ideas, what I think has been key to the inflation dynamics, we saw at the beginning of the crisis and where we're seeing right now. It's not just what everybody talks about the demand side, but also what's happening with supply disruptions so I'm going to show you a few slides now on recent work that I'm doing to try to understand how much supply disruptions in during COVID are affecting prices. This is joint work with Oleksiy Kryvtsov at the Bank of Canada.

What we are doing is again trying to tap into these alternative data sources in a new way. So many of us know that you know the supply disruptions, combined with the sudden surge in demand in some sectors, produce a lot of stockouts. You probably experienced these by going through many of the stores. Now turns out online, you can see, when a product is out of stock in some retailers, so we concentrate on subset of retailers that show this information. So I'm highlighting, for example, this product here was out of stock. I can see that information and put it into our database and then build an index of the share of items that are out of stock, which is what you see here for the US before the

pandemic started roughly between 12 and 13% of items were out of stock and then we see the sudden surge going up about 20%. And then a gradual decline basically until the end of the year, for us to see the same levels of stockouts that we had seen before. There are similar patterns in other countries, obviously with some [inaudible], some of the adjustment is quicker than others. Now interestingly, the stockouts were positively correlated, we as we might have expected, within sectoral inflation, usually with a LAN. So, when you're looking at here is simply a scatter plot of the inflation rate on a monthly basis but measured every single day. And then on the y axis, you have the fractional out of stock for the category of food and beverage is in the US. And the different colors and numbers show you the four months of the years so towards the end of February, we were around this level, and then we see a sudden increasing the level of out of stock towards the end of March. That starts putting pressure and inflation is rising towards the end of April we get to the peak of monthly inflation. And then there's a gradual decline that happens, until the end of July. So, there's this whole movement that it looks very sequential in a way. We have in the paper detecting that this was not only increasing prices but sectors that were experiencing stockouts were sectors where the retailers reduce the frequency of price declines, and if they had to do with price declines, they were doing it by a smaller magnitude. So in a way this was preventing prices from collapsing further, which I think is something that is unappreciated when you look at those inflation theories. People think that we haven't seen an increase, but we haven't seen the decline that we would have otherwise seen if we had not experienced the sort of supply disruptions.

Now stockouts decline that you may be thinking well, but that means we're out of the woods here. And here's where the data can seem tricky. And it turns out that stockouts seem to have improved. When you go to these retailers, you do not find as many goods as being labeled out of stocks, but what happened is that many of these companies, they removed completely some varieties and we have seen a decline in the total amount of goods that are actually offered for sale in these retailers. And you see here an index where I've normalized the number of goods, we find on the websites of these companies at the beginning of the pandemic. And today, we're roughly about 20% below in the total product availability, so I believe this is an indication that supply disruptions are still being quite important for many of these companies that are just having trouble bringing these goods back into the market. And this will certainly continue to put some upward pressure on prices for some months.

Now, I realize I'm out of time, I apologize. If it takes longer I'm happy to take questions afterwards, but let me just conclude with three ideas. One is, I think, online data and you know alternative data in general, provide a unique measurement opportunity. We can improve measurement not only for the speed, the frequency, but also the details and the customization we can give to some of the statistics. And it has also open up the possibilities for anyone to collect this data, which I would encourage many of you who are Ph.D. students to do. This is easier than it may sound. Now, if you do good measurements in real time, it's definitely going to be useful for short term forecasts or nowcasts, if you will. Particularly as I mentioned during times of crisis and shocks. But what I consider more important, I think, or more general, if you will, is that if we make efforts to improve our micro data we can greatly improve understanding on how shocks propagate through the economy, how they're passed on to prices and that will help us understand, you know, long term dynamics of inflation much better and allow us to make more sort of long term predictions for

where we are headed. So, let me end with that. Thank you very much and I'm happy to take questions.

Harrison:

Alberto, thank you so much, that was that was really fantastic. Alberto, thank you so much, that was that was really fantastic. Thanks for staying on time and also, I think, giving a huge amount of content that we can now use to build our panel discussion around. So let me, so I think that the arrangements are, let me introduce the panelists. We'll have each of the panelists make a few comments on Alberto's talk and then I will gather some questions also from the Q&A. So if you have some questions, please share them. So, Alberto, in the Q&A, I think there are already some technical questions for you. You feel free to answer those. It seems like you've succeeded in getting Ph.D. students interested, from what I gather from these questions. And then, and then we'll kind of wrap up.

So, let me, let me introduce our three panelists. Our first panelist Yves Lempriere is the head of Alpha Predictive Research. Yves works on a variety of signal research for CFM. He holds a Ph.D. in Cosmology and Physics MSC from Cambridge University. He also has a Master's in Mathematics from the Universite Pierre and Marie Curie in Paris and also a Master's in Engineering from the L'Ecole Centrale in Paris. Our second panelist, José Scheinkman, is the Charles and Lynn Zhang Professor of Economics at Columbia University. He's also the Theodore Wells '29 Professor of Economics Emeritus at Princeton and a Research Associate NBER. José has a long list of career accomplishments - a member of the National Academy of Sciences, Fellow of the American Academy of Sciences, Fellow of the American Finance Association and recently, he also won the CME group MSRI prize in innovative quantitative applications. Our third panelist is Michael Woodford, the John Bates Clark Professor of Political Economy at Columbia University. Michael also has a huge list of accomplishments as well, including MacArthur Fellow, Guggenheim Fellow, Fellow of the American Academy of Arts and Sciences. He's the 2007 recipient of the Deutsches Bank prize in Financial Economics, the 2018 recipient of the Banque de France/TSE Prize in Monetary Economics and Finance. Mike has written, arguably, the defining treatise on monetary economics, has interests in prices, foundations of the theory of monetary policy, that's sort of the Bible, at least as far as I can tell for the Federal Reserve Bank. And also, I think maybe more relevantly, Mike is also heading up the behavioral macroeconomics annual for NBER, which I think is going to be key if we're going to be touching on the topics that Alberto talked about such as, you know, the types of inflation that households are currently experiencing.

Alright, so with that, let me, let me kind of go in reverse order. Let me introduce Mike and ask him to make his comments. Mike the floor is yours.

Michael:

Okay, thanks. So I think Alberto, you know, gave a very stimulating talk and I think he's very much to be praised for his work launching the Billion Prices Project, this has been very valuable for creating a new source of information that's useful for a lot of kinds of studies. In my view, the particularly exciting aspect of it is the contribution that it can make to better understanding price setting by firms. This is a very central issue in macroeconomic modeling, to understand price setting by individual price setters in order to understand the process by which prices in general, adjust. And

for testing specific models of this, having very desegregated data on individual prices and having higher frequency data are both extremely valuable things. And so, this new methodology, I think, is going to prove very important for that.

The main theme of this session is something different, which is measurement of overall inflation and forecasting overall inflation, and so I want to focus mostly on that. I think it's clear that the Billion Prices Project can help us, to some extent with that it clearly allows faster information about what's going on with prices. That can clearly matter, particularly with what Alberto was calling turning points I think he demonstrated that very clearly. You think back to the onset of the COVID crisis all through April, if you only had the CPI data to look at, your most recent number would be the March CPI number, and that was still saying prices were higher in March than they had been in February. You would not realize from that that prices were falling, and many prices falling really dramatically, as he showed his time series would have shown you that from already early in March. Off, you know, through the later part of March and certainly on through April, you would have realized that for many weeks, prices had definitely been falling. And so you know, this is a clear example of how, if you want to know what's happening to inflation at a pretty high frequency, it can be very valuable to have this additional source of information. I think, though, it's important to point out that the thing that people most care about in tracking inflation, and I think both what policymakers both most need to know about, but also investors- what investors are really concerned about isn't so much where are prices this week. But asking what the outlook for inflation is over the next few years. So, not even the outlook over the next month or two, but the outlook over the next few years, which is what matters for asking if financial assets might be, you know very much mispriced. And what also matters for deciding whether policy, maybe is the stance of policy, in fact behind the curve, as people often say. And so the question is, you know, how can one learn about underlying trends in inflation that you expect to persist for a few years. It's clear that one would like to know about changes in those trends as early as possible. I mean that's obviously the case. But it's not as clear that more up to the minute information on prices that have already been set can really do a lot to solve that problem.

You know, when you ask what are people trying to figure out right now, it's clear as Harrison said in his introduction, there's a lot of concern right now about what's happening with inflation. I think a lot of people are asking, could it be possible that despite the fact that we've had consistently low inflation for the past decade and more. You know, might we be on the brink of a period where inflation is going to be higher? Meaning going to be higher, maybe for the next few years. That's a very important question, but it's mostly a question about things that haven't happened yet. Right? You need to start making guesses about how are people going to spend the stimulus checks that they haven't, most of them, haven't gotten them yet, but you know we know are coming. Additional unemployment benefits, how will they spend that money when they get it? When some firm is find increased demand for their products, what are they going to do then? How are they going to be setting prices? What's going to happen as more people are being employed as the economy expands further? What's going to happen to wage bargaining, you know, over the coming year and the year after that? Similarly, questions like policy questions you know, will the Biden administration, in fact, succeed in getting the kind of ambitious spending plans that people are talking about, but a lot of them haven't been enacted yet? What's the Fed going to do if, in fact, aggregate demand does surge and many people are facing capacity constraints and prices do start going up? It'll be crucial to ask

what, well, do you think the Fed is going to do? You know these are important questions, but we can't answer them by looking at what's happened to prices that are already being set. Now, these are these are questions about trying to make educated guesses about things that may be happening soon for reasons we know something about but that haven't already happened.

In the case of what you can learn about inflation trends from the data you already have, and it's certainly important to try to track inflation trends using what data you have, I think it's important to say well these desegregated prices can definitely help just looking at aggregate managers, like the last few months' CPI releases is clearly not the best job that you can do. People like the New York Fed publish on their website an underlying inflation gauge, which is an attempt to try to track underlying trends in inflation. If you ask how do they do that, well they look at very disaggregated prices. They don't just look at the past few months, the CBI, they look at various disaggregated prices because they want to look at which prices are going up more than others, to try to infer from historical correlations to what extent price changes are likely to be transitory components or represent trends in those prices. But they don't just look at this aggregated prices. To do that, they found they can do a better job of separating transitory price movements from trend movements by also looking at a lot of financial series, they also looking at a lot of real variables that help them in this forecasting question. Furthermore, when you ask well you know is better data on desegregated prices an important input, the answer is yes. But in the case of us which price information you want it's not obvious that the most frequently updated prices are the ones that are most important for that kind of calculation. There are a lot of prices that move at high frequency. The price of crude oil and things of this kind. Usually the prices that move at particularly high frequency, are the ones that are also most influenced by special factors that relate to the market for that particular commodity. They move a lot for reasons that don't have to do with the forces that are moving prices in general, and often are moved by special factors that have relatively transitory effects and might not want might-not think are going to persist. So it's not so obvious to me that really up to the minute information on the prices that are already being set and particularly looking at a set of prices that adjust more frequently is itself going to do too much to solve the real underlying problem.

Now, Alberto showed us some interesting evidence on what his index shows, right now. It shows the prices that he's looking at have been rising faster than the CPI since December, since Thanksgiving. And that's certainly an interesting question- what's going on there? I don't think that it looks like what's going on is just more timely reporting. These delays in the measurement of the CPI that are responsible for the difference. I think there's reason to think that at least an important part of this is differences in the behavior of the particular prices that are in his sample. And one thing that Alberto mentioned is that they sample many more goods prices than service prices because of what's available online. What we know from the official statistics is the goods prices have been going up more, much more than service prices recently. And so that may be what the difference is here. If that's what it is, should we think that goods price inflation reflects what the real inflation trend is a lower rate of growth of service prices is not. I think that's not obvious, I think that some of the difference in goods price inflation and service price inflation relates to factors that are probably temporary. The related to things that Alberto was talking about, that we know that in the recent period, the pandemic itself, restricted a lot of spending on types of services and shifted people's consumption baskets. Yes, that's occurred. That's probably not a permanent change, though, in spending patterns. It's probably something will change a lot, even in coming months as

the as the pandemic abates. Similarly, these temporary stockouts that he was referring to, I think probably have affected price setting and will matter for price setting over the next few months. But again, I suspect that a lot of that relates to relatively temporary circumstances and so it's not as obvious how much you should upgrade your estimates of the inflation trend and those things.

Harrison:

Thank you. Thanks, Mike for those comments. So let me, let me invite José. Please share your comments, thank you.

José:

Thank you, thank you, Harrison. I'm going to share my screen just because I want to show some graphs. Let me first thank Alberto for a great lecture and also congratulate him on this research project which is really fascinating and generating a lot of good stuff.

Now, it's interesting that this project had a policy, maybe political and good sense motivation. But the result is that is created an important tool for measurement and research. And I think that's a good lesson for our graduate students, for all the graduate students who are listening. Starting with a very concrete and practical question often generates some of the best work instead of trying to make something else more, you know, do something better that already has been done. Now the to the current discussion on the possibility of future inflation and the effect on nominal interest rates, you know, to the center the preoccupation of a lot of people, can be can split into two parts. First is how noisy high frequency measurements of price changes are. And the second one is how monetary authorities will react to forecasts of inflation. Now I didn't know the order we were going to speak so I said number two I want to leave to Mike Woodford who probably knows the monetary authorities personally and has been discussing with them what they want to do, what they were going to do. So he didn't say so much about that, although he did mention it some, but he spoke quite a bit about how more high frequency management of price changes. So I don't have much to add to what Mike said except that I think there's now a very interesting literature that combines a more formal way analysts forecast, other forms of forecasting that's coming from statistics, combined that with asset prices. And I think that that's part of what you can- I think informally what Mike said that the central banks do, but you can do that -there's a lot of interesting literature on that. And that can be an avenue to combine the PPP information with asset prices to see how well, can you do.

Now, to finish, I'm going to talk about something- I'm going to remind Cavallo of his early interest of price stickiness and also talk a little bit that, would also be saying something in the direction of at Mike mentioned, you know, how to use the high frequency data to test theories. So, you know, economists, as many of you know, economists have used many models of cost-of-repricing to explain the last mood changes of prices. Now, with my colleague Makoto Nirei, from University of Tokyo, I've been looking at models which have a finite number of goods, the traditional model. Consider the number of goods to be continuing, and some of these effects don't come up that we discussed here. In a model with a finite number of goods, when a shock lowers the cost of price adjustment of a good, that good may have its price increase - that increases the price level because there's only a finite number of goods, which has an effect on the price level. Goods which are close

to repricing are repriced, may decide, may be repriced, which in turn causes other goods to be repriced. You get a form of an avalanche.

Now here's what you can prove. With a large but finite number of goods, the distribution, the size of this avalanche, approaches what statisticians call Generalized Poisson Distribution. This is a two parameter distribution, I wrote the equation on board, you can look at it. It collapses, to the poisson with the parameter [inaudible] you can do zero. And the reason the statisticians like that is that you can have the, according to the data you choose, you can have the distribution to be either under or over the squares with respect to the poisson. Ok, and the coefficient of dispersion that's use in then used is [inaudible] is divided by the mean, can be shown to be one over one minus theta squared.

Now there's over dispersion with a finite number of goods, kind of slows down the convergence. The smoothness of the averages and so causes fluctuations in average price change. Now I give a stock theoretical talk on this at the econo-physics center at the Ecole Polytechnique about a year and a half ago, before COVID, of course, and Jean-Philippe Bouchaud, I don't know if he's listening, but he, of course, is the CEO of CFM, asked me, have you looked at the Billion Prices Project? So when I came back, I talked to two students, Laura Leal is at Princeton and Haaris Mateen is at Columbia, about this project and we're preparing a manuscript to look at the Billion Prices Project, what it says about this avalanche.

So, I'm going to show you just one picture the daily data price changes for Colombian supermarket data. And I use the V-Shape, we use the V-Shaped algorithm of Cavallo. You just concentrate on price increase, so I want to see how big are those avalanches of price increases. How do they look. And how they fit. Ok, in red, you have the data. So the data is the number of price changes in a day minus one. Presumably in this literature, one shock may be coming from this lowering of what people usually call the cover shock. The blue line is [inaudible] of the family of Generalized Poisson Distribution I gave you there. You know, just to the eye, it's a pretty good fit. And in fact, the theory explains why the fit is not so good below the median, which is, in this example, the log, the log of the median would be about 3.5 to 4. Now, the data that we obtain from this fitted distribution is .87. And that gives you just algebra, [inaudible] around 6. So this teaches you two things. First of all, the series comes out pretty well in this, with this data, and does with several other the data, and also simulation. But, on the other hand, he predicts a very large coefficient of discretion, which tells you that looking at high frequency data, you know, you 're going to see a lot of variation. Because in this theory, the leveling, the dispersion, the adjustment that each firm makes, at least according to the theory is in percentage terms, more or less constant. So it's a constant rate of adjustments, but you're having this large dispersion, you're going to have a lot of variation in high-frequency inflation. So, that's it. Thank you, guys.

Harrison:

Great, thank you. Thank you, José, for your insights. So now let me invite Yves. Yves, if you would like to make a few comments?

Yves:



Yeah, hi everyone. Yes, so first, thank you, Professor Cavallo for this very interesting talk. Very illuminating. Yeah, I really think, I mean, we have been very interested in the Billion Prices Project, so I can answer a couple of Professor Scheinkman's questions. Yes, CFM has looked at the Billion Prices Project, we have looked at that at CFM. Actually, I mean, just a few comments. So yeah, I definitely agree with the premise of the talk that we've just seen which is that governments lie sometimes. I mean, so it is very important, I think, that we have metrics, especially for us in the investment world, that allow us to have other measures. I mean, obviously, the example of Argentina, was very, very good case at hand, but we've seen other cases where there were question marks. You know, you read about China. Growth or inflation measurements here and there. Here in Europe, because we are, and I'm based in France, actually, we've had some issues with microdata from some countries like Greece, so it's definitely important, I think, and it's a very good idea that other metrics are available and true in this in this area of big data, it is actually a direction that is very good.

I would like to outline one really, maybe two big merits of the Billion Price Project. I think, from my investment perspective. One of them is the fact that it started in 2010 maybe even in the U.S. in 2008, for Argentina, maybe. So that is, I mean that gives us a decade of data, which is actually quite solid. Ok, a lot of, I mean you can have a lot of other alternative data providers, but usually you get data that starts in 2014 or 15, so this is this is really good. And I definitely agree with Professor Woodford, I think one of the great interests of this data is the granularity. The fact that you can really go down a lot deeper potentially at the company level I don't know how easy it is for you to link a product to a company. Like, you showed a kind of metric and you were able to link that to Nestle. I don't know how easy it is to do that on a systematic basis, but if that is the case, I really think a it is very interesting because you have the price formation at work here, and you can link that with other data sets, like credit card data, to really have an idea of the buying pressure, you can you can propagate that along the supply chain and look at fundamentals of the suppliers to have an idea of the supply and demand equilibrium, so I really think it gives you a very detailed picture of the supply / demand formation, the price formation. And I mean, from my perspective, I think this is indeed the maybe the most - I mean, that's one of the most interesting aspects of the of the of the project. That there's this really fine granularity because that is something that we let me very seldom see, actually.

So, I agree with the comment that was also made that it's true in terms of forecasting what really matters is it not only trading inflation it's often forward looking inflation. So, I mean, we have seen some interest, some forecasting interest in the Billion Price Project but, for example, if you if you try to see, for if a fixed income security is accurately price or something like that, usually forward looking metrics are a bit more useful than trading metrics and that's what the Billion Price Project is. On the other hand, I do think that, for a lot of more government-related issues, this is definitely something very interesting and very important like what Professor Cavallo has seen in this in this gap in the CPI measured using a COVID-related basket or the fixed basket at the end of 2019 that is definitely something that is very relevant for policies, for legislation and government related issues when it comes really to pricing.

Like I mean really fixed income world, I'm not sure that is really what we are looking for, but I really I really do think that, at a granular level there is a lot of information that can be extracted and I do

think this is really a massive endeavor. Actually, I'm kind of a big enthusiast of macroeconomic models. It's been very difficult for us in the quantitative investment world to really bent predictors out of them because data that is updated on a monthly basis, or monthly is for us CPI or the CDS are taken on a quarterly basis, that is actually very slow and, obviously, especially as we've seen in the COVID world, that is definitely- an economy can be shut down in a matter of weeks, so you need something which is more timely, which is a lot more up to date and definitely any endeavor to nowcast macroeconomic indicators and the Billion Price Project is one of the best candidates for that, I think that's of paramount interest for us, overall, so we are, we are following that very, very carefully.

Harrison:

Thank you, thanks for your comments. So I'm going to - before I aggregate there is a bunch of questions which I've aggregated from the chat, which I'll feed the panelists, but before I do that, Alberto, do you want to say a few words. I'll give you the floor in case something comes to mind as far as a panelist comments.

Alberto:

Yes. So those are all great comments, thank you very much for pointing these things out. And I completely agree with everything you've said, you know Mike Woodford made the point that this is potentially useful data not just because of the high frequency itself, but because of the desegregated nature. And that's how I started actually in my academic career, I wanted to test these theories we have about price setting and then bring some stylized facts that we can use to shed some light into those patterns. And I want to emphasize that I personally think that the greatest value of all these data revolution, if you will, is not just that we can see things faster, but that we can build indicators, and disaggregate the data, even for an academic questions, we can create the statistics that would best fit that question and allow us to answer. So, for example, on Mike's point about the more frequent goods that's an excellent point. Ideally, you know, if you're a policymaker you want to focus on the sticky goods that are likely going to be the ones

showing the best trends. Now the way we can do that now with the official statistics is by focusing on the core index and removing completely categories where prices adjusted a lot like food and fuel. But what we're working on doing now, for example, one of the things we can do with this data is not to remove completely some categories, but within each category you when when you see each individual good, you can detect which are the goods within that category that are actually, you know, high price changes and the ones that change more slowly until potentially you can build the same type of a basket in terms of categories that you cover, but only with the sticky versions of the sticky varieties. And I think that sort of indicator is something we couldn't build before. It should help us as academics learn a lot about the nature of price stickiness but it could potentially also be very useful for policymakers that want to build the sort of more stickier. So I completely agree with that point, I think even for the Ph.D. students watching, that's where the value of this will lie. Like as José was showing. I'm glad to see that this data is helping you know test some of those theories. I hope more of you will be able to access that.

I've answered a few questions in the chat already about getting access to this, but you can get in touch with price stats for research purposes, yes, absolutely. And I'm happy to, if you want to email me about specific questions later on, I'm happy to tell you more.

Harrison:

Thank you, Alberto. So we have about 10 minutes left in our program, so I'm going to aggregate a bunch of the questions and, as far as I can tell, I think most of the questions, of course, pertain to are all of these discussions about worries about this, sort of inflation, that will be coming up. As Mike kind of talks about in the next couple of years, right? With all the stimulus, etc. Do we think that or do we have a view whether this is likely or not, right? I mean that's sort of the summary of most of the questions on the chat.

And I guess I would start by sharing the following comment which sort of came from all the panelists which is: is it fair to say that Alberto's research explains why Americans might be worried about, or in fact, should be worried about inflation, just because of their experience? Right, but it's purely transitory so that all of the concerns that we're now kind of seeing spilled out into the media or even in, you know, treasury bonds, right? Some of these consumers or some of these investors may be selling their bonds because they're experiencing in some sense more inflation that's reflected in the CPI. Do I take this to then mean that we shouldn't really be worried about this coming inflation? Because, you know, most of the signals are kind of coming from very transitory factors that you know, ultimately, are going to work themselves out?

Mike, want to give a comment on that?

Michael:

Well, I really, you know, I'm not going to claim that I have a crystal ball. I would say people ought to think about it, though. I would say it's really, I'm not, I don't think that it's wrong to be concerned about the possibility of inflation. I think that looking at the price increases that people might already be seeing is not really giving them the answer. I think that if you ask why should anyone be concerned about inflation, why should they be asking these questions, I would say it's because of changes that we might think, have happened. Say, with regard to policy, you know the Fed has certainly changed the way it talks about its approach to inflation targeting, at least in terms of its communication strategy. There have been big changes in the past year. In terms of fiscal policy, we have a new administration that, you know, certainly is talking about a very dramatic change in the nature of US fiscal policy, I think those are the reasons why it makes sense for people to be asking: might be outlook for inflation be different? But as I said, I don't think that, say, well if we only had better information about the prices that have already been set in the last couple of months, that would give us the answer. I think it won't. I mean I think it's really looking more into what do you think is going to happen. For example, with fiscal policy. Also, what do you think the Fed's new approach really is. How different is it going to be from past policy, how are they going to respond if maybe a new situation develops that they haven't confronted over the past decade? And I think the you know, the question which prices, people are seeing right now is not going to answer that.

Harrison:

José, any thoughts?

José:

I agree with Mike. It's really, really hard to figure out, first of all, I think, part of the difficulty in this is that nobody knows how the central bank is going to react. Ok, right now, the central bank seems to be saying: we won't take very seriously inflation signals. Correct me if I'm wrong, Mike. For a while. You know where we want to see this inflation is really permanent or just a change in the price level. Now, how you operate, how do you make this operational, I have no idea, maybe Mike.

Harrison:

Yves? Any thoughts?

Yves:

Obviously, I'm not a crystal ball gazer either so it's difficult to give you my bet on that. What I wanted to outline, on the other hand, is the fact that it's not just the US consumer that is worried about inflation, right? I mean a couple of weeks ago there was a rally, I mean, the government, the US Government here rallied to it was really a bit of inflation fear around the investment world. So now it has quieted and the bonds have gone up again, but it is definitely a question that is not only worrying the US consumer, it's also something that a lot of people in the market are actually actively looking at and you see any small news related to that actually has an impact on the on the yield curves. So it is, I mean it is, it is a hot topic, if you want I can't tell you- if it's going to happen or not I honestly I don't know. Another central banker and I'm not even an economist, so I don't really know, but what is sure is that it is definitely something people are worried about and it's something people are reacting to. That's definitely something on the investment world.

Harrison:

So, I guess that I think the thing that's kind of the most interesting in framing Alberto's talk and Mike's comment is, you know, it doesn't seem to me, you know, so we see data that says people are concerned. But it strikes me that it's kind of unlikely that these households are concerned about Fed policy. It just seems like it's kind of far too sophisticated for them, right? They're mostly, all their concerns reflect their experiences and I thought it kind of in essence I thought Alberto's findings were pretty interesting. That, you know, like, if you look at the Axial poll, right now, I think the median forecast of the poll I cited, one year ahead inflation according for Americans it's like 3%. Right? And and you know it, so do we do have any sense of - do you agree with my comments that, you know, it seems like the Americans, the typical households expectations of inflation seems more driven by the past. right? Particularly what they've experienced. But I completely agree, of course, we should talk about the future and does that sort of affect and how we should think about these- what kind of signals, you know? What are we learning basically from from from all of these various surveys and these various signals that we're seeing also in the treasury yield markets as well.

Michael:

Well, I think there are probably different groups of people, right, that we're talking about. So, when you ask what are you learning from treasury yields, these are more likely to be determined by the decisions of people who do in fact follow the Fed. And do in fact, ask what Fed policy is really going to be like under this new regime. When you ask about broader surveys of what households are

thinking, I think it's probably right that, for the most part, those expectations respond a lot to people's personal experiences. And I think what studies have shown is that particular prices like gasoline prices seem to have a particular effect on the general public's understanding. But you know forecast of inflation or sense of what inflation is just because it's it's something very visible it's something they may purchase frequently if they you know they're a commuter driving car. They fairly often are observing what the gasoline price is and paying attention to it, but this is very different, I think, from what the expectations might be that are shaping shaky bond market prices. And if you ask what do we care about? We care about both for different reasons. We believe, so the general public could matter if one thinks that wage negotiations down the line could be affected by people's sense of how much of a wage increase they need to demand because of their sense of what inflation is, regardless of what the experts are saying inflation is. Although it would be at that point that you thought it was affecting wage negotiations.

Harrison:

José?

José:

Oh, I think I said what already I think about this topic. There are two parts to this, of course, there's the part of thinking what expectations are? And the part of thinking what is the Fed going to do? Because you know, the expectations are not really so much about the Fed. People make expectations, this is as Mike said, based on past behavior prices for the consumers. The markets may be more trying to figure out what the Fed is going to do, because that's part of what determines, you know, yields for treasuries and so on.

Now, as I said, some literature is now trying to combine those things. Most of the literature I've seen assumes they are the same players. And what Mike thought, which I think is a very important point, is that the people determine the treasury yields, partly, are very different than the people responding to the to the surveys. So how do you put this together when you have two sets of people like this, as he says, you both matter but in different ways. And I haven't I don't think anybody has done that.

Harrison:

Okay, all right. I think that kind of clears out most of the Q&A questions that are sort of aggregated. So unless there's any more questions - any last comments, Alberto, Yves.

Alberto:

No, I want to say that I agree completely. I think, you know, my results show me that inflation was higher at the beginning of the pandemic. And this can have affected some of those views that some consumers, particularly low income consumers, by the way to spend a lot more of their relative total spending on food ,may have experienced higher inflation and that certainly affects in some of those expectations. But I consider that to be a more short term type of effect. The supply disruptions that we were talking about, I showed you some results, I also can see those as a nice higher costs that many firms are experiencing, but they should be temporary. I don't expect it to extend for them for for more than some months after the pandemic ends, but we should keep a close eye on that and then and that's one additional force that may be affecting the numbers, we see towards the middle of

this year. And, obviously, how the Fed reacts, and hopefully lesser price they are, the better in in how they react will be very important.

José:

Harrison can I make one last comment about what the Alberto said?

Harrison:

Sure:

José:

This question about food prices- it's something I follow for other reasons. It is true, that COVID, the pandemic has increased food prices, because it makes certain much more difficult to produce. Migrants have a hard time getting [in]. So there's an increase in food prices from COVID. But what's simultaneous and it's something you've written about, but it's really big this year is the climate, the effect of climate. And so if we think that, so what we see now, what Alberto's seeing with prices is a combination of both things and it's as much as coming from climate, I think the expense will be much more permanent.

Harrison:

Thank you, thanks.

José:

It's hard, but it's certainly both there.

Harrison:

Thank you, thanks, thanks José. So let me kind of thank all the - let me thank Alberto again for such a stimulating talk, that was really fantastic. Blending both academics and also a very timely and important topic. Let me thank all the panelists for so succinctly summarizing. I think what is clearly a super important issue currently and also kind of, I think, very fascinating research issue as well, touching on all the things we've talked about. And let me thank Adam again and CFM for working with us on these events. So please, you know, stay in touch we're going to have another event. We sort of anticipate having these events, probably, you know, two to four times a year, so you should look out for that as well. Thank you so much.

José:

Thank you, Harrison.

Alberto:

Thank you, everyone.