Transcript of Research & Statistics Centennial Conference: The Evolution and Importance of Economic Measurement and the Role of R&S

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STEVE OLINER. Well, good afternoon, everybody. I'm really pleased to be asked to offer the opening remarks for this session. But before I do that, I need to come back to John Williams's comments about the recruiting out at Stanford in 1993. I think I interviewed you, too, and I remember writing in my notes, "We should really take a close look at this guy."

So I'm really pleased to be here. It's wonderful to see so many old friends and colleagues. I really want to commend the group here at the Board that was involved in putting this conference on. It's been a tremendous achievement—and really want to thank you for doing that.

So I'm currently a senior fellow emeritus at the American Enterprise Institute. And what that title means is that I'm retired, but they allow me occasionally to come in and have lunch. I spent most of my career here at the Board in the Division of Research and Statistics. I was here for 27 years, starting in 1984. I came to the Macro Section, worked on business investment, and then, as many people have commented, your first job here is a springboard often to lots of other jobs. And I was fortunate to have a lot of other jobs.

You know, as I reflect on my years in R&S, what I'm really struck by is how lucky I was to have worked with such a stellar group of people. My R&S colleagues were smart, they were well trained, they had the highest commitment to intellectual integrity, and they were devoted to public service.

It was extremely stimulating to work here, and it was instrumental in my development as an economist. And there was really no other place I could have worked where I think I would have learned as much.

In economic measurement, it wasn't a conscious decision. I didn't set out to say, "I'm going to be a measurement guy." I came to the Board having written a thesis on business investment and tax incentives to spur investment. This was a hot topic during the Reagan Administration in the early 1980s. And with that background, as I mentioned, I was assigned to work on business investment in the Macro Section. And through that work, I became interested in the role of business capital in generating economic growth, and that led to an interest in the measurement of capital stock, especially for computers and other high-tech assets.

And in the early 1990s, the division facilitated this measurement work by letting me buy an enormous set of historical computer industry Blue Books, and provided a small army of interns and research assistants to help me analyze the data. That was kind of my start on measurement.

A puzzle at the time—again, this is the early 1990s—is why productivity growth had remained so sluggish, even though it seemed like we were surrounded by computers everywhere. So Dan Sichel and I teamed up to address this question in the first of what'd ultimately be 12 papers that we would write together. And the answer in that paper was that the impact of computers on growth through the early 1990s remained limited because computers depreciated rapidly and had very short service lives so that even though there seemed to have been a lot of investment, the stock of computers at that point was still very small compared to the entire stock of business equipment and structures.

But that story changed dramatically in the second half of the '90s, as the paper really nicely documents. At that point, productivity growth had accelerated, and Dan and I teamed up again to reexamine the growth contribution from the high-tech sector and found that the tech sector was indeed the factor driving the faster productivity growth.

So, what had changed? Well, it was really two things. The first is that there had been an investment boom starting in the mid-1990s in computer and communications equipment that had been driven by the development of the internet. And the second is that the Industrial Output Section in R&S had developed price indices for semiconductors that showed the prices of these goods had started to fall much more rapidly starting in the mid-1990s, which signaled that productivity growth in that sector had really picked up.

Now, we really couldn't have done our growth accounting work without the advances in price measurement that were being done basically down the hall. Dan and I continued to measure the growth contribution of IT in subsequent papers, three of which were coauthored by our colleague at the time, David Byrne. David is still here and very active, of course, in this area.

So let me now introduce our panelists. It's a distinguished group, and I'm pleased to have Carol and Arthur on the podium with me. The paper will be presented by both of them—Carol Corrado, Arthur Kennickell—and will be discussed by Chris Carroll and Dan Sichel.

Carol and Dan and David Byrne, too—I need to mention Dave, who contributed to this paper—they've made enormous contributions to the measurement of hi-tech and tangible equipment and their contribution to growth. Carol is currently a senior policy scholar at the Center for Business and Public Policy at Georgetown. Carol served in R&S for 30 years, retiring in 2007. Arthur is a giant in the field of household survey design and implementation. He's currently an affiliated scholar in the Stone Center on Socio-Economic Inequality at CUNY. Arthur served in R&S for 33 years, retiring in 2017. Chris Carroll is a prominent scholar in the field of household spending and saving behavior. He's a professor of economics at Johns Hopkins and a research associate at the NBER. And while his time at the Board was relatively

short, I looked back at his vitae, and it was clear it was exceptionally productive. Dan is a professor of economics at Wellesley College and, like Chris, is also a research associate at the NBER. Dan's time in R&S spanned a 24-year period from 1988 to 2012, punctuated by a couple of breaks when he was at Brookings and the Treasury Department.

So with that beginning, why don't we turn straight to the paper? So we have about 25 minutes for a paper presentation, 10 minutes each for the discussants, and then we'll try to leave about 10 minutes for Q&A at the end.

CAROL CORRADO. Okay. Well, thank you, Steve. That was a nice introduction. Okay, now can people hear me? After the lofty discussion by—speech by—John Williams, I was thinking, "Oh, my goodness. We're going to get up here and talk about measurement. We might as well sort of put on some clerical collars or something like that." [Laughter] But Steve sort of livened it up a little bit, and I'm hoping we can keep that tone.

So when we started working on this paper, we found it difficult, actually, to try to organize our thoughts about what kind of narrative we would present. You can probably tell by the title listed here—it's not the title in the program. Sorry. I'll explain that in a minute.

So one of the things we first dealt with was, "Well, let's just talk about different kinds of data or different kinds of measures. Maybe that's a good way to organize our thoughts." And it's pretty clear that some aspects of measurement work in R&S involves just the creation of what we call primary data, or survey data. And that actually doesn't engage a large fraction of the staff. But the effort that goes into it and then the publication and the rollout of it ends up being often a very big deal, especially in the case of the Survey of Consumer Finances.

Many other statistical products are constructs, or they're systems of data, and they draw upon, like, many secondary sources, organized in some sort of economic framework, whether

this is the financial accounts or the IP index or the measure of capacity utilization. We're talking about blending a range of sources, often with some framework in mind. And then still other measures are maybe the product of modeling concepts such as potential GDP, or it's an exercise in filtering certain indicators into some compact form for routine use.

Well, that latter part—that latter group is very large. It could be used to describe some statistical products or statistical releases. But it's also pretty much the bread and butter of a lot of the forecasting that goes on. So the other thing we did was to consider—I'm sorry. Let me just interrupt a second to say, I am, like, so wedded to using Presenter View in PowerPoint that I can't sort of live without it. They didn't have the capability here to do it, so I'm going between two different things here. So all my notes are on my iPad.

Okay. Back to the content here. So information—a lot of the evolution of the statistics in R&S is to plug information gaps. And when you start to write down what that list is, it's enormous. I couldn't even in small print fit it on a slide. I tried, as Arthur knows. But, you see, the various initiatives and the various things that have been done to improve products over the years—it's always the response to. And, most recently, people in this room are probably familiar with the initiative to enhance the financial accounts. Well, that happened after the financial crisis, in which the detail on the nonbank intermediaries just wasn't there for anybody to see the leverage that had been building up—and where, in principle, you could have that there.

I mean, that project is going in many different directions. But that's, like, hugely important. So that's one way to tell the story. However, it makes a very lengthy narrative, and we already have limited time, and we wrote a 50-page paper not even taking everything into account.

So the other sort of approach is to look at—to consider that a lot of measurement involves solving economic puzzles, and it does require a mindset that I think is unique to the Division of Research and Statistics and that sort of—this mindset that says, "Well, my model isn't fitting. Do I go back to the drawing boards on my model, or do I dig into the data?" And you're not taught—when I went to graduate school and, I think, for many of the people in this room, we were taught theories and hypothesis testing, but not, "Well, maybe this data's wrong"—was never the way that you were taught to go.

You walk through the door here—and I hate to say it, but it was 45 years ago—and I thought I was really smart, because I was supposed to do some work on consumption, so I opened up the last, like, five years of the AER, flipped all the pages, which was all you could do then, and flagged sort of articles on consumption. Well, I remember reading this one article having to do with, like, environmental standards where it basically said, well, no matter what you set, what you did about regulation, imported cars were always 10 percent of total cars—that all these things that people had done didn't make any difference. So I come to the Board, and I say to Larry Slifman and Steve Roach, "Oh, you're forecasting cars. Well, I know imports are only always 10 percent of total sales." Well, these guys cracked up. I mean, they just totally cracked up, and they're—"what are you laughing at?" They go, "Carol, that's how BEA estimates imported car sales." [Laughter]

Okay, so, what are we going to do? I'm sorry, this is a really lengthy introduction, but—whoops. How's this? Okay. But our talk is going to be organized around solving puzzles and overcoming barriers, mainly computational ones. And we just have four puzzles, and it touches upon selected statistical products. That's what we're going to talk about today. The paper covers more territory, but this is all we can do now.

So, what's the first one? "New economy or not?" So let's go back to the early to mid-'90s, back to when John Williams started, but to sort of like the other side of the hall. So how were—what were we thinking about then in terms of solving the puzzle of what was going on in the economy? Well, first of all, the press was rife with talk about a "new economy," especially after a proclamation by *Businessweek* that we were in one. *Businessweek* had taken inspiration from a lot of the early work of Erik Brynjolfsson and Lorin Hitt that was circulating in the academic circles at the time. It really hadn't been published yet. That was one thing.

But inside the Board, again, the picture is a little bit different. The other thing that was was going on was that there was this very influential piece of work by Dave Lebow, John Roberts, and Dave Stockton talking about bias in the CPI that Greenspan famously included in testimony in January of 1995. So if you think of the press at the time or you think of the mindset of people on the FOMC, the Committee members, which included a couple of economists, they're thinking, "New economy or not? Price measures may be biased."

Meanwhile, in briefings, we'd brief on IP, and the sector was booming. In fact, by 1996, semiconductors was the largest U.S. manufacturing industry. Most of the PCs that were showing up on people's desks were actually produced in the United States. And what would become the largest cellphone factory in the world actually was located in Fort Worth, Texas. So we had a booming economy, the internet was a rage, and price measurement was strangely in the news.

And so, what was the puzzle that needed to be solved? So the puzzle was that labor costs were rising, corporate profits were well maintained, but inflation was maintained. And that was in mid-1996. Now, the labor market was hot, and this sort of—just loosely speaking, this kind of trifecta only makes sense when the aggregate productivity data is—the growth is increasing.

And this puzzle—Alan Greenspan, he tapped Larry Slifman on the shoulder and said, "Get to work on this."

And, basically, we were not charged with looking into whether there was a new economy—that was off the table. We were to look at why it was corporate profits were well maintained, in essence, and to dig into that by industry, by sector of organization, whatever. And the bottom line was that, based upon work that was done, Greenspan argued before the Committee in September 1996—remember, the Committee has "booming economy" in their mind, "price measures are biased"—presents these arguments that labor productivity is biased. And they failed to raise rates, which is what the market had expected. And you could say Greenspan certainly was right. Whether you say it's for the right reasons or not, that's beside the point. He got what he wanted. And it did make a difference.

So there was, again, as Steve said, a lot of talk about whether we were even measuring IT right. And Mike Prell supported an initiative that came out of the IO Section that paid for data to measure prices better. And without going into the details—and the paper does provide a lot of background on that—there was a lot of success with this initiative. The results—we were able to take advantage of private data, which is sort of the rage now. But we were very early in the game of that. And not only were we able to bolster IP, Steve and Dan used the results, and it definitely—the approach that was taken garnered interest among leading price measurement folks.

And, as you're going to see in a minute, Arthur has all these delightful pictures, and I only have one. And so here you have Ana and I celebrating with other leading price measurement people at the Summer Institute.

There was a lot of follow-on work. And, actually, Dave and I wrote some papers that summarized all that work. And these are just some charts that sort of do the same thing. And once the domestic production sort of dried up in this area, we went on to do work on IT services and supply chains. Dave did the work on supply chains. So all these papers here—there's, like, a collection of them. It's some combination of Dave, me, Dan, working and continuing to work in this area. And [break in audio] early in the cloud computing space, we were very early in talking about telecom prices. And when you work in this area, you build near-geek-level knowledge of the technology, and Dave's a walking example of that. And I just put on the priestly collar. And so he was able to step up to some of the issues with the supply chain bottlenecks of late and help the Board out in that regard.

So now let me go sort of—well, right, the other part of the new economy. Well, there's missing investment. And this is what I spent a lot of my time on since leaving the Board. I don't need to wave the flag so much here, but basically to say that the other area of our work was to challenge the investment boundary in the national accounts. And we've had, like, a lot of success in that area.

But it was all kicked off with a conference held up here in Dining Room E, where Dan and I and John Haltiwanger organized it. Chairman Greenspan offered welcoming remarks. It was one of those conferences where you have a theme, you make an announcement, then people write papers for the conference. And Barbara Fraumeni jumped up and asked Steve Landefeld, "I want to write a paper on capitalizing R&D," because she knew what we were going to do. And 10 years later, R&D was capitalized as investment in the national accounts. So I would say that that conference that the Fed hosted, the division hosted, was rather consequential.

So just real quick, I don't have—I'd like to say more about the financial accounts than I even have in this presentation. And I'm running out of time already. But the financial accounts have really a very rich history that we partially review in the paper. We could even expand that. But it involved the transfer of a major project at the NBER to the Federal Reserve. Ralph Young, who was the division director, was instrumental in acquiring that project. And it had been run by Morris Copeland, who stayed at the NBER and sort of wrote a book, a theory. But it came to the Board, and they developed accounts, and the person who worked on that was Dan Brill.

So we had two division directors that were responsible for that the establishment of this product at the Federal Reserve. And for many years, it was synonymous with one person, and that was Steve Taylor, who, as anybody who knew him—he rode his bike to work every day. So I didn't have a picture of him, but I had to memorialize that.

So let me just sort of jump to say that, from the domestic macro point of view, the FAs have been instrumental and played a big role in modeling financial influences on household behavior. And this goes for—and this was embedded in the Board's quarterly model. And when it was first launched by de Leeuw and Gramlich in 19—well, it was really 1967, but the article that I'm referring is published in 1969. And the paradigm there was really kept that way up through the inaugural version of FRB/US in 1996.

But that sort of isn't the way things are now for a lot of—because we've just learned so much about consumers and how the homogeneous—or the representative agent model just really doesn't work, and you really need more and different data on households. And Chris Carroll contributed to that area of research. And I think if I want to move quickly, I won't go over the details.

I was also going to talk about debt, which, again, you've no idea, particularly if you were here in the '80s, how much people talked about the rise level of households. And if you look at this chart, you can see that steep rise that occurred in the middle of 1980s. That's what it was all about. It was talked about more in the *Bulletin* than—you know, there's always an article in the *Bulletin* on it, in the press, and what have you. But, of course, what followed was so much more consequential. But the thing is, nobody ever found a regularity with aggregate consumption for reasons that we now understand. And so I think the Fed was good to—was prescient in looking at all of that. They just needed the microdata to sort it out.

So with that in mind—and I'm going to not say a whole lot about the distributional accounts, but they are a super amazing contribution in and of themselves—I will conclude my part of the presentation. But I want to say here that—what are these two pictures? On the left is an old IO workshop from the late 1960s. Actually, it's 1966. I forget when the Apollo mission was, but about then. But, remember, *Hidden Figures* was where all the computing was done in the back room. That's talking about a mission in 1962. So, you know, '66, '62. There was just so many changes going on at that time. And, originally, the IO Section was rather slow to respond to that.

But all that changed with the amazing Charlie Gilbert, who's pictured on the right, who basically led the effort to develop processing procedures that allowed you to visualize data, which, again, was a big thing back then. And that's where I'm going to stop, finally. Sorry for overrunning.

ARTHUR KENNICKELL. So I know that we're actually fairly close to the end of our time. And, unfortunately, I'm going to run over if that's—either that or I can go through and just

show you some pictures of people. But if you bear with me, I can—don't worry. If you can put up with me, I'll do it.

STEVE OLINER. I'm not worried.

ARTHUR KENNICKELL. Okay. All right. So this is the continuation on microdata. And what do you get when you go away from the streetlight? You find all the keys that the drunks who were searching by the streetlight for their key have left behind. You've got a lot of microdata, and it's heterogeneous.

So over the past 50 or more years, there's been increasing recognition that micro—that macrodata alone are not sufficient for understanding everything about the economy. This is a big step forward. In particular, heterogeneity actually makes a difference for a lot of purposes. So I'm of necessity going to be skipping—like a little stone skipping over the water—over a lot of issues, and there's a lot of depth underneath them. And I apologize for people and things I'm going to leave out, but I've got to move relatively fast here.

So the longest-running thing, obviously, is the collection of banking data, which underlies monetary statistics. Most of this happened before the separation of MA and R&S, so I won't go into that. But there were significant contributions in Research and Statistics on the research side—for instance, the paper by Bill Barnett developing the Divisia monetary index that we call MQ; work by Paul Spindt, who was a coauthor of Barnett and a leader of the first and, actually, also the second survey of currency and transaction account use. I also worked on those two surveys. And there's Bill Cleveland, Augustin Maraval, Darrel Parke, and David Pierce, who worked on uncertainty in monetary statistics. And three of those guys were also the nucleus of arguably one of the most important centers for work on seasonal adjustment anywhere in the world.

So probably the longest-running nonregulatory series is the surveys of finance companies. It's a complicated survey. I can't go into all the details. There are just too many pieces. This has gone along since 1955, providing data for the G.19 series in conjunction with banking data. Things moved along reasonably well over a long period of time. But like what happens with many things, the world changes. The way that we measure things needs to change because the things that we're using to define the logic of our measurement process decays. And this happened to this survey.

So 2010, the landscape of finance companies has drastically changed, and we needed to do a revision of the survey. And working with my colleagues Lisa Chen and Kathleen Johnson, we wrote this paper "Discovering the Universe," which we thought was a really cute title about discovering the universe of finance companies.

I need to make a very brief detour, but an important one, to the University of Michigan, because after World War II, R&S put money into work on surveys at the University of Michigan. And a lot of this work was led by the great economic psychologist George Katona, who worked on things like consumer expectations and purchase intentions. You know, people were worried about all this money that had been stocked, socked away over the war, and that could be an explosion of consumption or not an explosion of consumption. So George Katona was looking into this, and his work was very influential on things that happened later at the Board. And, indeed, a descendant of his work, the Michigan survey of consumers, is probably still familiar to a lot of people here.

So the big breakthrough occurred for the Board in 1962 with the Survey of Financial Characteristics of Consumers, which was led by the great Dorothy Projector with Gertrude Weiss. That's Dorothy Projector on the left of the screen with her trusty Monroe desk calculator

behind her, an advanced computer. This was the first survey ever to collect comprehensive wealth data, and there were other, smaller surveys before. But this is the first comprehensive wealth survey. And not only that, it was the first wealth survey that had a sample that enabled estimation of wealth across the full spectrum of wealth levels, including very wealthy people. And this makes it the first true antecedent of the SCF. And really extraordinary efforts were devoted to making this survey work—both operationally and in cleaning up the data for use.

So where did it all go? I don't have time to go into all this, but just get a load of that picture on the upper left. This was advanced computing. This was a paper tape reader. So this is what people had to deal with. So—and she was very limited by that.

So they collected this first wave of data. They collected a second wave of data from the same set of households. This was the very first panel wealth data—so, something that people don't often remark on. And there was evidence in the files that I inherited from the last staff member in her group that showed that questionnaires and sample designs had all been created for a continuing survey, that the next round of the survey had actually been undertaken. It's not clear whether all the data had been collected or not, but we know that some of them had been coded using that advanced coding machine on the lower left-hand side, a FOSDIC machine. But we know it was never finished, and searches of the Census warehouses have never turned up the data, so nobody really knows what happened to it.

So why did it stop there? Why did we have such a long lull after that? Well, maybe part of it was the limitations on information processing and the amount of staff time required. But this last staff member also said to me that Dorothy Projector was once approached by a senior official in the division who asked her to do a simple calculation to support some policy work.

And she is reported to have said, "I have better things to do with my time." So whether she said that or not, I don't know. But, certainly, lesson learned for everyone.

So there was quite a long lull after this until 1976, when a request came from the Senate Banking Committee for information about credit use by households. And this was the spark for the 1977 Consumer Credit Survey, which was run by Tom Durkin, together with Gregory Elliehausen. And, again, this drew on some of the work of George Katona.

So there's a fermentation going on now. People are thinking about surveys. Here's my old pal Bob Avery there on the left. So around 1980, you have this confluence of things that are happening there. There are laws, there's deregulation, there are changes in marketplace—other agencies are being hit by changes in laws, regulations, and mandates. And one common thread across all these groups is the need for wealth data in order to undertake whatever the local task is for that agency, including the Board. And, wisely, people realized that there were synergies in having one survey, not a whole pile of them. And that became the 1983 SCF, which was developed in R&S, and it was led by Bob Avery, together with Gregory Elliehausen. And I became involved after the data collection was completed.

So this is a broader survey than the '62 survey. It's just much, much more information about wealth and contextual information about wealth. But like the '62 survey, it also had this special sample that allowed you to say something about the wealthiest households.

And we have to thank Fritz Scheuren, who is in the picture on the left here, who was courageous to a degree I don't have time to talk about today in making it possible for us to get access to IRS [break in audio]— there were many, many technical problems with this survey, some things that almost destroyed the entire process. But in the end, with a lot of hard work, it

was successful, and it was successful enough that we were allowed to conceive of this as a triennial survey.

So, what happened then? Well, money is the really big problem. So we had a 1986 survey. The Board did not want to spend much money on this. We had to create something very bare bones. It was barely adequate for the specified tasks, but really not very broadly useful beyond that. And this was recognized. It's not worth doing things on the cheap. That was what Ed Ettin said.

So we get to 1989. There's the expectation that there's going to be this full-blown survey, and the Board puts in more money. But it still doesn't put in enough money to pay for it, and fundraising is required. So this is where I got my life experience MBA in marketing—going around to other agencies with a little tin cup, saying, "Wouldn't you like to give some money to the Federal Reserve?" [Laughter] And I never knew I had such sales ability, because it actually worked in the end, but just barely.

So why does 1989 matter, and why am I dwelling on this? It's because 1989—there was this very serious revision of the whole questionnaire, and the technical procedures were all rebuilt from the bottom up. So it becomes the benchmark for all of the subsequent SCFs, of which we now—we have 12. So it's a tiny time series, but I always promised division management, "If you just leave us alone long enough, we'll make a time series for you." So, right there—there it is.

But it continues to survive by the skin of its teeth. It has funding, but this is a really tough project, and the people who work on it are just really amazing. I've just so much gratitude for them for their hard work. So this is some of the friends of SCF, where I boldly include myself there at the bottom.

So there's other survey work I should at least touch on. There was the Survey of Small Business Finance, which was conducted four times starting in 1987, run by John Wolken there and Traci Mach. This collected balance sheet data on small businesses, very valuable information, but it was canceled, unfortunately, in 2003. Its influence lingers on in the SCF, as work that goes on in the System that's tied to this, and there's a lot of work outside. This is viewed as a really important and valuable survey, and its influence will last for a long time. There were a lot of other surveys, mainly ad hoc—some omnibus surveys and so forth—but I don't really have time to get into any of that.

I really must say something about the work of financial economists. There's just—this is so heterogeneous. It's really hard in this small amount of time to get into a really meaningful description of just the degree of heterogeneity of work there is. But I think I can just give you a very high-level picture that these economists most often are working with data that they get from MA or BS&R or both of them or other sources within the Board, together with market data, vendor data. It's really complicated managing this data because you can't just stick things together like you can when you have panel data and you have an ID that aligns things. There's just a lot of creativity and approximation that has to be done. And the staff are really adept and artful in doing this.

I wish I had time to say more about why Linda Powell was there on the screen. This has to do with the role of standardization and the work that we did together on the legal entity identifier. But read the paper, and you'll learn more about that.

So, finally, I get to my last topic here, which is the recent innovations in measurement. This is really a reason that I wish I were still back at the Board, because I'd love to be involved

in this. This is the most rapidly evolving area in measurement—not just at the Board, but a lot of places—and even aside from AI. I think the really substantive statistical work is happening here.

So the people at the Board have always been engaged with data from outside the Board. And, in particular, the Board used to have a so-called seat at the Census Bureau, where someone with sworn status could go and get information that was needed for the IP Section. This is really cumbersome and limited, but, fortunately, under the leadership of Norm Morin, a Federal Research Data Center was established here at the Board, which provides access to restricted-use—a much broader range of restricted-use microdata, federal microdata. And so this is really a big step forward for being able to access such data. You've still got to negotiate what you use, but it's just much better than having to go to the Census Bureau.

And there's several things that have given a tremendous push in this direction. Some of them are laws, and perhaps the most important is the so-called Evidence Act, the Foundations for Evidence-Based Policymaking Act. And this law requires agencies to start with the presumption that all federal data should be made available for purposes of evidence-based policymaking. It's still subject to constraints of statutory limitations and confidentiality constraints. But this is a really big step forward.

So this is important, but there's really a lot more because nontraditional data is a lot more than government data. I mean, nontraditional data is basically what we used to call "big data" before that fell out of fashion. It's just any kind of data—sensor data, credit card data, accounting data, satellite data, and health data—anything that you can think of; it's data on some population.

And this started to come into a much sharper focus in 2014 when Chris Kurz, Norm Morin, John Stevens, and Micheline Casey, who was then our CDO, went out to the Bay Area

and interacted with tech companies out there. This was followed by a lot more interaction both with people locally and with visitors to the Board. And the result of this was that Dave Wilcox created two new groups. One is a group in the IO Section that's focused on the so-called extended measurement agenda, or EMA—and thanks to all the people who made that possible—and a new section to work on filtering and nowcastings with Gianni Amisano and Travis Berge.

So let me give you some examples of progress on EMA. I have to go through this really quickly. I'm just going to give it to you high level. There's so much more to be said about this. So, using data from ADP, they've developed a weekly, almost real-time measure of payroll employment—this is incredible—then available much before official measures. They worked to develop measures of consumption in response to a variety of different types of shocks, constructed new time series on business formation—okay, I'm just about done—and this came into really sharp focus in the COVID-19 period, when they were able to provide more timely, granular, crisis-specific estimates for employment, consumption, and business starts. They're working now on text analytics, natural language processing, machine learning, large language models—really exciting. I bet you all wish you could work on this. So thanks to the EMA people.

And, finally, a salute to a hero of Carol and me and, I'm sure, to many of the others of you here: Peter Tinsley, who foresaw a lot of this from a long time ago. Thank you very much. [Applause]

STEVE OLINER. Thank you very much, Carol and Arthur. Our first discussant is Chris Carroll.

CHRIS CARROLL. Okay, quick reaction. So I am delighted to be here to see so many old friends and to be discussing this paper. So my first suggestion for the paper is that they just

change the subtitle into the title, because it's such a brilliant subtitle—"Beyond the Streetlight." And so I'm going to present a little bit of empirical work that I did, which you will see the relevance of when I get to it. But I would like Kostya to click on "Beyond the Streetlight." Oh—it worked earlier. I think his—yes, his internet connection must have gone away. They took it away from him. We tested all of these links earlier, when they worked. All right. Well, just go on back. That's right. Okay. There we go.

So, what that is supposed to take you to, and does if you don't have internet problems, is a repository—there we go—that contains all of the little bit of empirical work and all of the slides and everything that is part of a project to basically make everything replicable in economic research. And so the slides and everything that's in them are replicable, and you can get to it by clicking on that link.

I have already assumed that they will change the title to "Beyond the Streetlight." [Laughter] So that's the title of the thing. Okay. So next slide, Kostya—or, no, I can do it. Yeah, there we go.

So I wanted to start just by saying thank you to everybody in this room, to all Fed staff, past, present, and future. I think people don't say thank you enough for the incredibly important things that all of those past, present, and future Fed staff will have done. It is a vitally important job and almost impossible to say how important the job is. David Wilcox was right earlier when he said that there've been global ripples—and important ones—from the things that we do here. And I think the staff past, present, and future have done this job as well as humanly possible. So thank you to everyone.

So the paper is, of course, about measurement. Is there any way to make this a little bit bigger? So when I was on the job market, measurement was uncool in academia. There was a

widely circulated paper—"Theory before Measurement," by Ed Prescott that said we should just, like, forget about measuring things. We have the right theories, and we don't need to worry about trying to measure them. And there's a quote in the paper from David Wilcox that reflects the reality of the time, which is that an awful lot of macroeconomists, even those who pretended to be doing empirical work, spent very little time trying to understand the data and didn't understand at all the extent to which their results might be an artifact of the data instead of an actual fact. Carol's story was wonderful on that.

But when I interviewed at the Fed—and had to think about, where did I want to go?—like John Williams, I realized I had a choice. At the Fed, measurement was always cool from the beginning to now and off into the future. And—oh, let's see—if I had to choose between the two, of theory without data or data without theory, I wanted to choose data all the way. I wanted to be a person grounded in reality, which I felt much of the macroeconomics literature was not.

So the paper makes an identification between measurement and, basically, information production. That's kind of a definition of what it is that we're doing when we measure things. And between primary and secondary sources of information, I would add a tertiary source, which is—I used a little mathematical notation there—books in the set of Green, Teal, and Beige, staff memos. We heard from Eileen earlier today about the very high quality of many staff memos from a long, long time ago. And I feel like that is a kind of measurement that only the Fed can do, because only the Fed has all those data, but that has a great deal of value for people trying to understand, what was the Fed thinking—what was the mind of the Fed at the time it did this, that, and the other?

There are also possibilities of learning a much richer story of the history before we had our national income and product account measurements, because the Beige Book goes all the

way back to the 1920s. Again, talk to Athanasios Orphanides to be evangelized on this subject, but he is very persuasive.

So, what good is this information? Well, "Greenspan Fed Called the 'new economy.'" That was part of the story that Carol told us. And the *Economic Report of the President* in 1997 sort of went whole hog on the Fed story about the new economy and estimated, in particular, that productivity growth had been—labor productivity growth—had been 1.3 percentage points greater than the NIPA accounts showed. And I can't avoid mentioning that those numbers were constructed by Steve Braun, who is here somewhere.

And to the extent that people worry about conspiracies and the Fed taking over everything, well, the "new economy" text in the *Economic Report of the President* was made with considerable consultation between Steve and the people here at the Fed. And that proposition—and Carol underplayed this a little bit, the extent to which it drew a lot of criticism, the idea that there was a new economy and that's why we didn't need to raise interest rates. And it drew a lot of criticism from mainstream economists—I remember this vividly—but particularly of the type that David Wilcox was criticizing, the ones who didn't have a data-based view of the world. And there was criticism from the political left and the right for very [break in audio] reasons.

So then the question is, what good did it do to be able to measure all of this stuff better? Well, as Carol said, it allowed the Fed to be easier in its monetary policy. But she didn't mention what I think is probably a pretty important sequel or something that was a consequence of this. The Asian financial crisis happened the next year. And the fact that the Fed felt that it had room to do whatever was needed to address that crisis is probably a hidden implication that

was pretty important at the time. It also allowed for the opportunistic disinflation, as I think Orphanides described it as. So I'll skip the Google Ngram.

And then there's the question, okay, was the Greenspan Fed just lucky—he happened to have guessed right with no basis? Or, you know, the purpose of improving our measurement is in part to be able to make a better forecast over time—more deeply to understand the economy better. But if all of this effort to do measurement better has been successful, then you would expect that forecasts would have improved over time. And so here is the absolute error of Fed forecasts back to 1983. And, as you can see, the red line captures the trend according to which the Fed will reach the point of zero errors—at the date when the Eccles Building is finished, I think. [Laughter]

Okay. And so—but you might not find this very convincing evidence, because maybe everyone has improved their forecasts over time because there's just better data of all kinds. And so the wonderful thing about the tertiary data from the Philly Fed and FRED, especially the Philly Fed, is that I can do exactly the same enterprise with the Survey of Professional Forecasters data. And although it might be a little bit difficult to discern, it's true that the Fed—it's true that the SPF forecast also shows declining errors, but the trend decline is only 0.3 for the SPF, and it's 0.4 for the Fed. And, furthermore, the—oh, sorry. Furthermore, the mean squared error of the regression is only 0.59 for the Fed, and it is 0.69 for the professional forecasters. And the absolute error of the Fed is 1.02, versus 1.10 for the SPF.

If you think about it, an improvement relative to the professional forecasters of 10 percent—the value of that to improved policymaking and to the world and to the American people is probably many, many orders of magnitude greater than the salary of all of the people

who have been engaged in this measurement improvement exercise. And so it has richly rewarded us, I think.

A final thing to touch on is a question that is just right now becoming kind of a hot topic in macroeconomics, which is how much of the business cycle is driven by uncertainty. And so here's some results from a paper by a student of mine who basically is finding that roughly half of the fluctuations in GDP over the business cycle in a New Keynesian model in which employed people have some worries about the future that are calibrated to match the degree of uncertainty that people actually face in the real world—uncertainty accounts for half of the fluctuations in GDP over the business cycle. And I would propose that the thing that the Fed needs to do going forward to continue this research agenda is, we need to measure people's expectations and beliefs much better, and we need to model those expectations and beliefs. The Survey of Consumer Expectations from the New York Fed—thank you, John Williams—is a great step in that direction. But I think expectations are the next frontier, and the Fed needs to get on the case of measuring and modeling expectations. Stop there. [Applause]

STEVE OLINER. Our next discussant is Dan Sichel.

DAN SICHEL. Hey. So, great to be here. Good to see everybody this afternoon. It is wonderful to be back. Happy 100th birthday.

So I actually was at the Board in three different stints—as a summer intern working with Pat Parkinson in 1984, after graduate school as an economist, and, as Steve mentioned, I left for a bit, came back later as an economist again and, ultimately, as part of the official staff. Basically, couldn't stay away—the gravitational pull was just too strong. That does mean I'm one of the rare set of folks who went through Board orientation three times—a little painful, but I survived. So for those of you who've been at the Board for a dozen or more years, I'm a familiar

face. To those of you who arrived more recently, I suppose I'm one of the older folks who's brought back to reminisce about the old days. I'll do a little bit of that but also want to talk about the paper and related topics. As Steve mentioned and Carol mentioned, I was privileged to be deeply, deeply engaged in the work in the paper that it describes on R&S research on information technology, productivity, related economic measurement issues.

I should mention I really got my start in measurement as an economist in what was then the Economic Activity Section. Dave Stockton was the section chief when I was hired. And I remember—I've got to tell my Dave Stockton story. I remember interviewing with Dave, and he—I was thinking about a more research-oriented section at the Board. And so, "Well, you can go hang out with the guys in the white lab coats, or you can come here"—again, following another theme—"get your hands dirty with data. Your research will be better if it's informed by more of the policy debate." And, again, I knew what the right answer was. And I said, "Well, yeah, I want to join Economic Activity, of course." And the work there, starting as an investment analyst and then as the inflation forecaster, really got me deeply into economic measurement. Understanding where the data came from, how they're put together is really how I got my start in economic measurement.

So, that said, I actually suspect that my most important contribution to the division and the Board—and the one that perhaps has had the most longevity—is my coauthorship with David Lebow of the Word List. [Applause] So in 1992, David and I, having spent a number of years at that point working through Greenbooks and memos, got quite fascinated with the way that language was used so carefully at the Board. So we put together this list of verbs and adverbs to describe data that increased or decreased. Here's the list. This is a copy of the original version. It's in Wordmark. It wasn't a Class II document, so I could take it with me when I left the

Board. And, in a way, this is measurement because really what we're doing is creating a concordance between the words describing little increases up to words describing big increases, and then ranking them in order, and then the adverbs that would modify appropriately. And my understanding is that Economic Editing still uses this.

David and I actually did this originally as just kind of a lark, almost a joke. We were a little concerned that the then division director might not be that entertained by the joke, but it was okay. It didn't end up being a career-limiting move. And so that was the Word List.

Okay. So, returning to the paper, when it circulates widely—it is a wonderful paper. It covers—it provides an amazingly comprehensive account of economic measurement work in the division in past decades, covers several broad areas of important research. I won't read the list. You can see it there. I do want to highlight, as Arthur emphasized, the final point about use of nontraditional data, because I agree with Arthur that that's really a central area, a really important area, where, both at the Board and statistical agencies, there's going to be a lot of change and a lot of growth.

Again, as I said, the paper provides a wonderful narrative of key developments, why things happened the way they did and the consequences for policy in the economy. And so, in a sense, I'm going to fall a little bit short in my role as a discussant. You know, I could quibble here and there. I could probably pull out one more of those 12 papers that Steve and I wrote that they should have cited. But that would be tedious and boring. I'm not going to do that. So I'm going to talk about things that are kind of paper adjacent, highlight one area where I think some additional work might be interesting, offer one additional theme that the authors might want to highlight in the paper—and with some thoughts on future measurement challenges.

So the paper very explicitly focuses mostly on recent decades since the 1960s, reaches back with the industrial production and capacity utilization discussion. And it's really by design, and that's really what the paper set out to do. I think a casual reader might come away with the idea that prior to that time, there wasn't really much interest in economic measurement. So that could be—that's possible. I think it's also possible that there just isn't so much of a record of that earlier work on economic measurement. I understand that Monday's session got into the history a bit. We heard some of that this morning in the history of research at the Board. So my hunch—and it's just a hunch; I didn't do hard, serious work—is that there was interesting work on economic measurement in that earlier period.

So I did just a couple of Google Ngram searches going back to 1900. So this one looks at the phrase "measuring business cycles." And this isn't, of course, focused specifically on R&S. This is the American corpus and Google Ngram set-up for phrases appearing in books published since 1900. So, peak in the 1920s, also in the mid-1940s, and then again in the 1960s. So my guess is that economists at the Board were engaged in these same sorts of issues of measuring business cycles and that that might not be something that we would today recognize as economic measurement, but in the context of the time, I suspect very much was economic measurement.

Here's another one. This is "bank statistics." And here we have, the peak is high early in the 1900s, and then, not surprisingly, a peak in the 1930s—and, again, suspecting that there was a lot of interest in these statistics. And, indeed, there is a book published by the Board, used to be in [break in audio] first edition was published in 1943, but a compilation of data that had been in *Bulletin*s, annual reports, and so on. And so, again, it may not be modern economic measurement, but I think there was a lot of work on economic measurement in that earlier period.

So the paper highlights—and, again, when the paper circulates more widely, you'll see more of this; hard to, I think, fit all of this into the short amount of time in this session—but highlights some key themes of kind of economic measurement work in the last number of years. I really like the framing of the paper in terms of, Research and Statistics is a factory for providing information relevant to its mission. And it's very much the way I thought of my time at the Board and sort of what the enterprise was that we were all engaged in. It highlights then, in terms of changes, the huge explosion, expansion in the variety and sources of data that have become available over recent decades, the parallel expansion in computing power to analyze and manage the data.

And then there was also this really interesting point that Carol touched on about kind of the culture of the division and investigating tensions within and across different data sources as kind of an essential element of R&S work. And I really like that. I really think of that as an important element of the R&S culture in the sense that if multiple data sources or information sources are telling a different story, don't just do the quick hit that might provide a quick answer and get some immediate traction, but take the time to really dig in, figure out what's going on, understand why different data sources of [break in audio] answers, and really gain a deeper understanding of the underlying issue and data. And I felt in my time here that was really a key piece of R&S culture, and it's something that I think is incredibly valuable about this institution.

The paper also highlights how changes in economic measurement are a reflection of changes in the economy. And, indeed, I think that's a theme that the authors could add in—that there really is this kind of a degree to which the economic measurement provides a mirror to the economy—with a lag, absolutely with a lag. I think researchers in R&S are just as quick as

anyone to see emerging trends. But it takes time to formulate sensible research questions, to assemble relevant data, and do the kind of careful analysis that R&S is so known for.

The lags are a real thing—there is an important lag, and it'd be great if those could be shorter, but probably not. You know, the first paper that Steve and I wrote on information technology and productivity growth, 1994—seven years after Bob Solow's quote about, computers are everywhere but in the productivity statistics, even more years after the introduction of the IBM PCs. The lags are real. But, nonetheless, just as research in R&S is a mirror on the economy, so, too, is economic measurement a mirror on the economy.

So I look forward to seeing continued contributions by R&S researchers, I think as economic measurement continues to track economic developments. I have a few listed here. Again, I highlighted the one at the bottom on the important use of nontraditional data and the rising and growing use of that.

And let me wrap up with just kind of a pitch. It's hard to overstate the contributions of R&S on economic measurement. I've seen this from a lot of perspectives—seen it from the Board, as an outsider, seen it from work with BEA Advisory Committee, seen it from work on a National Academy of Sciences study on modernizing the CPI. And R&S has just done pathbreaking work, particularly on the use of nontraditional data. And just want to make the case that, you know, continue to share that expertise with other statistical agencies. There are big social welfare gains that can come from that. And I can assure you, the other agencies are not as far along as the Board is and would really benefit from continued collaboration and contributions of the expertise of R&S in the economic measurement front. So, really, as kind of a penultimate thought [break in audio], it's a jewel in the crown of the Fed System and also of the economic measurement community.

So, finally, something a little different just to wrap up with. As some of you know—didn't happen when I was at R&S, happened after I left—but I've become a fan of haiku. So I wrote a couple [break in audio]—one directed at the authors: "Excellent paper / On R&S measurement / Thank you to authors." And then one for R&S more generally: "R&S we love / Tops in economic measure—in Econ measurement." Sorry, I slipped in extra syllables there. "Keep up the good work." So thanks very much. Delighted to be here, and a wonderful conference. [Applause]