Interviewer: Hello, and welcome to Annual Reviews Audio, a podcast from Annual Reviews, where insightful research begins. I’m your host Mia Lobel. On each episode of our show, we’ll speak with a top scientist in fields ranging from astrophysics to sociology. Today, we’ll talk with Kenneth Arrow and Timothy Bresnahan, colleagues in the Department of Economics at Stanford University and coeditors of the *Annual Review of Economics*. Timothy Bresnahan is chairman of the Economics Department at Stanford and has made significant contributions in the study of industrial organization and the economics of technology. Kenneth Arrow is a pioneer in neoclassical economic theory, breaking ground in social choice theory, and general equilibrium analysis. He was a joint winner of a 1972 Nobel Prize in Economics and winner of the 2004 National Medal of Science.

Gentlemen, thank you so much for joining me.

Arrow: It’s a pleasure to be with you.

Interviewer: Professor Bresnahan, let’s start with you. Based there
in the heart of Silicon Valley, you’ve written a lot on the tech industry. What has interested you most about this work?

**Bresnahan:** So, the late 20th century had a remarkable coincidence of technological opportunity and growth needs. The growth need of the last 50 years has been for something to permit white-collar automation. Since the Industrial Revolution over the previous 250 years, the rich economies had made enormous progress in industrial automation, which mostly hits blue-collar work—human physical labor. And, white-collar automation circa the end of the Second World War was increasingly a problem. We were putting more and more of our most skilled and trained people into work that was not increasing dramatically in productivity.

Computing technology, information technology, networking technology, software technology has both shaped that white-collar automation opportunity and been shaped by it. So, I’ve been interested both in the influence on the direction of technical change in computing software and networks of its biggest customer, which is white-collar automation, and the influence of computing and networking on things like the income distribution of the rich countries, where the increase in the demand for skills, which has emerged as a result of computer-based white-collar automation is very large and has contributed to a significant spread out in the income distribution for the rich countries over the last half-century.

**Interviewer:** For either of you, how is the current economic crisis, you know, there are 20th century opportunities for more white-collar work, but right now there are very few jobs.

**Arrow:** That’s going to be a problem. Of course, we have had business cycles. Let me first emphasize, the modern economy, the capitalist system has been marked by recurrent deficiencies of demand, current situations where people were put out of jobs. That’s not new. Even if you leave out the Great Depression, and you shouldn’t leave that out by any means, you’ve had recurrent bouts of unemployment and even a financial crisis, well, going back to the 19th century. This is not a new phenomenon, so it’s clearly an inherent phenomenon of a decentralized system.

And so I don’t expect the problem of getting jobs is not one that’s going to be a permanent problem. Now, that said, it may well be that the demand for the—a certain kind of highly skilled labor, very highly skilled labor, which is a very small number of people, may indeed fall permanently. The kind of income represented in the the financial sector— The financial sector used to be roughly 10 percent of the economy. The profits of financial corporations in 2007, I believe it was, were something like 50 percent of all corporate profits.

This is not a sustainable situation. So, the question of skills has to be interpreted. There’s a demand for people making, say the $100,000 level, but there’s a demand for people at the $1 million level and that part probably will, I believe, will be for some time—one can never make long run predictions—but for some time, will be a lot less than it is today. So, one has to differentiate what you mean by skills here. There are skill levels and they’re ultra-skill levels. There are people in the upper one tenth of 1 percent of the distribution where most of the gains have gone in the last 10 or 15 years.

**Bresnahan:** Let me jump in on this one too. I think one of the things we’ve learned from the computerization of finance, is that the use of information technology and finance, both creates very levered opportunities for individuals and groups of people to do tremendous good. But, the scale of transactions permitted by the computerization of finance also permits a very large scale of efforts of all kinds of cheating, stealing, and chicanery and the ability of the rest of the
economy, particularly of the policy formation part of the economy, both in macroeconomics and in banking and financial regulation, to keep up with that increased scale of individuals behaving badly. Technological change outran the regulatory system and we’re now in circumstances where we need to continue to get the benefits of long-run changes that come from improvements in white-collar work and have the regulatory and financial and macroeconomic control systems catch up to them to take out the disadvantages.

**Interviewer:** I want to change gears just a little bit. Professor Arrow, you looked at the economics of medical care back in 1963 in a paper you wrote for the American Economic Review. How do your findings from that time stand up today, especially considering what’s going on right now with healthcare reform?

**Arrow:** Well, if I may be immodest, I think they’ve been totally confirmed. The point I made there was that health insurance, not only health insurance but actually the whole running of the health system, depends on a set of considerations which were not really recognized by economists or by practical people either. And what I really recognized in the analysis of medical care was that the different parties had different information.

And they weren’t bargaining with each other on the basis of some gains mutually understood. The doctor knows more about medicine than the patient does, that’s why he’s a doctor. Similarly, the insurer at the time I wrote that, these were insurance companies, the HMO was yet to be invented. So, these were insurance companies, which dealt with doctors, reimbursed them for expenses. But, of course, they were not in the position to know the need, or whatever that, the value of medical care as well as the doctor did. So, the doctor could overly prescribe, what’s sometimes called moral hazard, simply because it pleases the patient and it isn’t costing the patient or costing the patient less than the cost.

So, the idea that there are these problems of communication, now say that people dealing with each other with different information. That begins to get very sophisticated—if that person makes an offer to me, he must know something that I don’t know. If he asks in fact, “Why is there any buying or selling on the stock market?” Why does anybody—After all, the seller thinks it’s better to sell. The buyer thinks it’s better to buy. They can’t both be right. And, the only explanation has got to be something like they have different degrees of information. I’m oversimplifying a little bit. There are other considerations, but I think to explain the majority of the transactions, that’s still a correct statement.

So, it turned out this principal of law applied to healthcare and, of course, it’s showing up today. You get these stories about the government getting between the patient and the doctor. Well, the insurance companies and HMOs get between the patient and the doctor all the time. And, it’s an essential, in any insurance system, that’s bound to be the case. They have to acquire information.

So, I think this is a—but I think it’s a pervasive tendency in the economic system, which is exemplified very strongly in the healthcare and creates problems, meaning that, well without going into—I could go into more detail that I’m sure you don’t want, but it means, for example, the idea that people should not be barred because of previous conditions, becomes an essential part of any genuine healthcare reform and then to enforce that. Now, there is one—I have got to say—there is one consideration in the healthcare issues which I really didn’t think about and that’s the distributional. There seems to be a perception, accepted by almost everybody, at least with lip service, that people should not be deprived of healthcare because they can’t afford it. Suitable healthcare, what that means.

So, there’s a redistribution—in other words the poor should not be deprived of healthcare,
simply because they’re poor. And, I think that perception, applied of course to old people in the form of Medicare, applied to working age people through Medicaid, and the question of extending that is part of the issue. So, there’s more to the issue that what I said in 1963. But, every other thing I said in 1963 is still absolutely applicable.

**Interviewer:** Speaking about Medicare and Medicaid, Professor Arrow, can you talk a little bit more about the role of government as a regulator?

**Arrow:** Well, the government is in the position of being a provider as well as a regulator. Of course, in fact, something like 50 percent of all health expenditures in the United States are paid for by the government today. So, with all the talk about socialization and all that, is really a little silly. We’re talking about extending it by a few percent. The real problem is the future. The fact is that our ability to spend money usefully in health is much greater today than it was in the past. That’s the biggest cause. Healthcare expenditures are rising—rising relative to national income everywhere in the world. They’re lower. The United States is spending by far more proportionately than any other country, but every country is seeing increasing fractions and the fundamental reason is that doctors can do things today, expensively, which they couldn’t do at all in the past. And this is the part where I won’t go into the progress which very uneven, some diseases like cardiovascular are greatly reduced, by expensive procedures. Open heart surgery, helicopters flying people, stroke victims in and such things like that.

That weren’t available 40 years ago, so you didn’t spend the money. So, we’re going to have to face this question, and the government is going to have to, is in fact, first place, paying for it. When it pays for it, it regulates. Because it has to control its expenditures. So, we have various—a vast amount of regulation now. I’m not sure that—

The problem really rises out of the government expenditures, which themselves lead to regulations to prevent them from being excessive.

**Interviewer:** And, this applies to more than just healthcare, right?

**Arrow:** Well, that particular problem, healthcare, is financially the biggest one. Education, of course, is a very traditional function of government, and the issues aren’t quite the same, and of course, there’s social insurance, but medical help is by far the most rapidly growing and biggest part of the story. Regulation in other—this is not to say that regulation is not important in other dimensions—I’m saying rather that, regulation, like the financial sector, which is extremely important. I concur completely with what Tim said, is that it doesn’t involve government expenditures, it’s basically purely regulatory. And, that’s a different story.

**Interviewer:** Professor Bresnahan, would you like to comment?

**Bresnahan:** If you think about ways where the economic wellbeing of people could continue to improve going forward as rapidly as it has over the last couple of centuries, several things come quickly to mind. Probably the biggest is extending the benefits, which a few countries, United States, Western Europe, have found from the Industrial Revolution, to the rest of the world. There’s an enormous amount to be gained from that.

And, then if you ask, how about continued improvements in economic wellbeing in the currently rich countries, that leads you to a short list of really big areas. One is white-collar automation, as I said earlier, another is healthcare. Some, as we have had some improvements in
healthcare and in living standards, we have people who are living longer, who would like to have better quality of life over their whole lifespan, and would have to have longer lives.

There’s an enormous opportunity there to create benefit. And, the other area, I would say, where there’s a cost we didn’t know we had, which is the costs of environmental damage. So, another area that’s very important to continued improvements in human wellbeing is finding a way to minimize and avoid the costs of environmental damage going forward. So, I would put healthcare in the equation as a potential area of benefit, agreeing there with Kenneth.

I also think that one of the ways the United States stands out among the rich countries is in the way we finance healthcare, is that we’ve set up a public finance time bomb for ourselves. Particularly by giving a tremendous number of people—my generation, the baby-boom generation—is sitting on the right to buy an enormous amount of healthcare services with other people’s money, particularly with tax money, and we have not solved the problem of how we’re going to pay for all that. So, there’s the problem.

There’s a money problem, but I think there’s also a tremendous technical opportunity and that that technical opportunity won’t be realized unless we get the economics of it right. By which, I mean, getting the market organization, the incentives, and the regulatory structures right going forward.

**Arrow:** I just wanted to stress some of the points that Tim made, particularly he’s mentioned the environmental problems, and there are two interesting things about that. First place, some of the environmental problems that arouse attention, say in the immediate post-war period, particularly air pollution and water pollution, have in fact, interestingly enough, been quite well addressed by a combination of regulation, of government works, and this is an example of a successful story. For another question, the nature of regulation has come under question, plus, the economists have always typically argued that simple regulations, say prohibiting something or say you can’t do more than so much, tend to be inefficient compared to saying, “Well, you can do what you want, but here you have got to pay a tax for it” or “You have got to pay a price,” in some form or another.

And, this has been successfully applied to things like emissions from industrial plants. Now, however, we’re faced with a worldwide problem of climate change. I think myself this is a very fair amount of data, I actually had some metrological training at one point in my life, so I actually, in fact, and I was taught, one of the things we were taught in those lectures was that industrialization means production of carbon dioxide and carbon dioxide is going to warm the world. So, when the furor came up 20 years later, I said, “Oh, yes, yes, that’s what I learned.” And, I think this is a serious problem.

I think that some evidence that economic problems in some countries already, being the particularly tropical countries, are already being seen. And, this is going to require a form of regulation and indeed economists have persuaded the world, at least in some level, that cap and trade or taxes or something like that is a superior alternative. Unlike many of the problems like air pollution this is not a national problem but an international problem. It’s a global problem. As carbon dioxide spreads around the world in 24 to 48 hours.

And, the ways it’s going to play out politically is of course still with us.

**Interviewer:** And, what is the role of the economist in this?

**Arrow:** The economists have been arguing as to essentially the use of the price system as a method of control, of having, for example, issuing tradable emission permits, putting a—composing taxes, and there’s been quite a bit of discussion using both data and theory on the questions of the
implications of different levels of energy control. The European Union has already adopted this policy. The United States seems to be hovering at the edge of it, finally, after many years of discussion. Unfortunately some of the emerging countries are much poorer, say, “Well, you used up the atmosphere, you put your carbon dioxide in the atmosphere, and created the problem, why should we suffer?”

And, there’s some justice to that point of view. However, it’s not going to be very helpful if everybody goes together. And, China and India particularly as very large countries, are going to have to be brought on board, maybe in a timed-phase manner. But, I think this is one of the largest problems facing the world, and we don’t have the benefit of a national government, a sovereign nation, which can impose things on it, so— Of course even within our sovereign nation we’ve seen, as we see in the current health discussion, coming to a decision is not easy.

But, it’s even harder when you have many sovereign countries.

Interviewer: Professor Bresnahan, what are your thoughts?

Bresnahan: So, the economists clearly don’t have an enormous amount to bring to the party on the physical science of the atmosphere. Kenneth’s training in meteorology notwithstanding, I think we should leave a lot of those technical issues to our cousins in the physical, biological, and engineering sciences. The question of how to achieve some reduction in “bads,” increase in carbon dioxide in the atmosphere being the big new one, but various sulfur oxides being the one of a generation ago, the question of how to cut down on those “bads” without stepping all over “goods”—without cutting off economic growth, without ensuring that the self-enriching and industrializing southern half of the world stays in poverty.

The question of how to get both the ‘goods’ and the ‘bads’ is an economic question, and the question of how to organize regulation and markets to trade-off. Avoidance of the ‘bads’ and achieving of the ‘goods’ is primarily an economic question. And, as with a number of other—

Let me throw in here at this juncture, I think a very positive remark about the current state of the organization of the economics profession, which is there are a lot of really good young economists right now. More than—more really good young economists than in my 30 years in the profession are working right now. And, they’re flowing, these really good young people, to the big problems of our day. They’re flowing to financial regulation, they’re flowing to development economics, meaning the study of the improvements in the currently poor countries. They’re flowing to the study of education and crime in the United States. They’re flowing to international economics. And, they’re flowing to the study of environmental problems.

So, I think we’re growing a generation of topically oriented, policy-focused economists who are going to be ready to engage with the details of difficult questions, like how should a cap-and-trade system be set up exactly, because the market question of exactly how a cap-and-trade system works, is as difficult as the engineering question of exactly what would you like to cap.

It’s a different question, it’s our ground. And, I’m delighted to report that this change that comes, I think largely just from having a lot of really good young economists, that people are flowing towards the policy problems in enormous numbers.

Interviewer: That’s a fitting transition to my last question, which is where do you see the field of economics going in the next 5–10–30–40 years?

Arrow: Well, there’s a phrase that’s been attributed to many people: “Prediction is very difficult, especially the future.” I think the thing that intrigues me of course is that predicting innovation
is a contradiction in terms. The new ideas will be the ones that you don’t know anything about today. Let me offer, nevertheless, some things which I think that are germs today. And, one of them which is already getting be quite well studied is the fact that behavior of individuals is frequently not rational, in the sense that the word has been used in economics.

Economic having been based on the idea that somehow people are rational, which means a kind of consistency; they process data according to—as statisticians would like them to process data. And, there’s lots and lots of evidence that this is not true. And, there’s some generalizations about the ways in which people make mistakes. In my own mind, I think another very important area is social connections. In effect, economists say people interact with each other through the market. They make, form opinions, they inform beliefs, they have values, but they interact through the market.

The fact is, I think that, and especially when you stress the idea of information, that information flows in many ways, which are not involved in the market. And, we know if you look around you, see there is a large body of newsletters and information. And we know that some detail studies you can show that people on the inside take advantage of the information they have, which means it spreads but spreads only gradually over time.

Similarly, when there’s an innovation, when there’s some technological development, it doesn’t—even though it’s superior—it does not get adopted immediately. Some people do it. The fact that they’ve succeeded lets other people know that it can be done and so forth. And, then sometimes there’s extraordinarily long passage. Sometimes things are adopted very quickly.

And, I don’t think we entirely know why. But, clearly one aspect of the matter is how people are connected to each other. In the labor market, how people get jobs is clearly motivated by who they know, for that there’s a lot of direct evidence. So, I think the question of social networks and the social connections, not just buying and selling, but the other kinds of information and other kinds of connections people prefer, well to point people they know to jobs or something, or include them in deals or so forth. So, I think the sociological side, which the sociologists I think could’ve done more with than they have, is going to be one very valuable development.

**Interviewer:** Professor Bresnahan?

**Bresnahan:** I think we’re going to see, and again, there’s nothing that makes you feel like an old person more than attempting to predict what young scholars are going to do. But, also being an old person gives you the right to predict what young scholars are going to do and they’re polite at least, as long as they’re in your presence watching you do it. I think we’re going to see an enormous increase in the volume and policy salience of empirical economics broadly understood.

And, I point to two dramatic changes in the circumstances of empirical economics. One has come to us as a gift, which is the increase in computerized record holding, not just computerized record holding in the government’s statistical system, but computerized record holding by companies and in markets has create enormous databases which are being exploited in very clever ways to study all kinds of policy problems and to study the behavior which is salient to understanding all kinds of policy problems at a scale never undertaken before because the data access costs were always too high. And the second really big change has, we’ve brought ourselves, which is that there’s also been a tremendous increase in economists creating their own data with our eyes on the statistical problems that come from using data that were gathered for nonscientific purposes.

And, so you see field experiments, especially in the field of development economics, you see interview studies that are tightly linked to existing administrative records in big databases.
So, there’s both more data that bear on the really important economic problems of today and more data being created by young economists that gives them even more purchase on those problems. And this data attraction is pulling young people closer and closer towards a wide range of important economic problems.

So, my forecast would be that our practical, applied, engaged with policy side is going to grow in strength fairly steadily over the next couple of decades.

**Interviewer:** Professor Arrow, Professor Bresnahan, thank you so much for joining me.

**Arrow:** Thanks, Mia.

**Bresnahan:** Thank you very much.

**Interviewer:** You’ve been listening to Annual Reviews Audio. For over 75 years, Annual Reviews has guided scientists to the essential research literature in the biomedical, life, physical, and social sciences. Learn more at Annual Reviews dot org. I’m Mia Lobel, thanks for listening.