

**Tim Phillips [00:00:00]:**

Welcome to VoxTalks Economics. Coming to you from the PSE CEPR Policy Forum at the Paris School of Economics. My name is Tim Phillips. In this episode, is green growth possible and how do we make it happen?

**Tim Phillips [00:00:30]:**

Philippe Aghion is going to be talking about this on the final day of the conference, but I didn't want to wait. So today I've put my microphones in a bag and I'm going to his office in the College de France to find out what he's going to be talking about. Not every Parisian train has its own accordion player, by the way, but this one does, so I thought you'd enjoy it.

**Tim Phillips [00:00:58]:**

Philippe. Welcome to Voxtalks Economics.

**Philippe Aghion [00:01:00]:**

Good morning.

**Tim Phillips [00:01:01]:**

Philippe, a lot of the economic research into climate change policy considers innovation as exogenous. Just something that happens. Should economists be thinking more about the role of innovation?

**Philippe Aghion [00:01:13]:**

I think innovation is the best hope for climate change. Of course, we need to innovate in our day to day behavior, but we'll fight climate change because we will find new sources of energy that are cleaner than coal or gas, and because we will also find ways to produce with energy saving devices. And so innovation is really key to the challenge of fighting climate change.

**Tim Phillips [00:01:37]:**

And are we saying that governments should intervene to direct that innovation?

**Philippe Aghion [00:01:43]:**

Yeah, they should, for the following reason. Research, including research I've done myself with various co-authors, shows that firms that innovated in dirty technologies in the past tend to continue innovating in dirty technology in the future. It's what we call past dependence. You tend

to continue doing things that you used to do well, and so you need government intervention to redirect technical change towards an innovation, towards green technologies. And there are various instruments to do that. But it's true that absent any form of government intervention, you have this past dependence problem whereby firms stand to spontaneously continue doing what they used to do.

**Tim Phillips [00:02:23]:**

Because I assume that there would be just a huge growth in green innovation already. But you've done the research on this, haven't you? You've measured it using patents.

**Philippe Aghion [00:02:32]:**

Yes.

**Tim Phillips [00:02:32]:**

Distinguishing between the brown and green patents?

**Philippe Aghion [00:02:32]:**

Yes, yes that's right.

**Tim Phillips [00:02:38]:**

But also between important and trivial innovation. How do you do that?

**Philippe Aghion [00:02:41]:**

This is in joint work with John Van Reenen, Ralf Martin and Antoine Dechezleprêtre and other coauthors and David Hémous. We focused on the automobile industry. That's a paper in the JPE in 2016. We focused on the automobile industry, and we could classify patents according to the extent to which they would be more related to combustion engine or to electric cars. And we had a classification, which is the IPC classification. And then using this classification, we could show that firms that have a large stock of dirty patents tend to continue producing dirty patents. So that's how we showed evidence of the past dependence. Since then, more work has been done on other sectors than automobile and showing similar patterns on other sectors.

**Tim Phillips [00:03:27]:**

And that's because they have business in the dirty industries they have skills in...

**Philippe Aghion [00:03:32]:**

Yeah, they have skills. They know how to do it. They know how to innovate there. That's right. So you tend to continue innovating in things where you are on the top. That shows by the way, that the energy transition is bound to slow down productivity growth because you will force firms to move away from things they know well to do into things they are less good at doing at first, then they end up being good at them. But for a while you have reduced productivity growth. So there is always a cost of the energy transition. The question is to minimize that cost and so what should we do to minimize that cost? But there are some people, like Michael Porter claiming that it's a win win that in fact you would speed up growth at the same time as you would fight climate change. That's not true.

**Tim Phillips [00:04:14]:**

You hear that a lot, don't you?

**Philippe Aghion [00:04:15]:**

That's not right. I mean you are bound to slow down but because you force firms to move away from things they were very good at doing into things that they are less good at doing and there is a learning curve, of course.

**Tim Phillips [00:04:25]:**

So if you're going to do that forcing, what is the least painful way of doing it? As economists always look first of all to a carbon tax.

**Philippe Aghion [00:04:34]:**

So first the thing is to act promptly because if you delay you make the problem worse. It's like the dentist parabola. I say if you wait to go to the dentist the cavity gets deeper and more drilling is required. It's exactly the same here. If you wait longer, firms will be even better at dirty technologies and it will take longer before their skills on clean technologies catch up with their skills on dirty technologies and so you need to act promptly. So that's the first. The second thing is that of course the carbon tax is an instrument because if you have put a carbon tax to reduce the profitability of innovating in dirty technologies. So carbon tax or carbon price is a tool to redirect natural charge but it's not the only tool. You need other tools as well and the other tool is subsidies to green innovation and more generally green industrial policy that is also required.

**Tim Phillips [00:05:21]:**

Why is the carbon tax not enough?

**Philippe Aghion [00:05:23]:**

Not enough because you have usually in public economics when you have more than one externality, you need more than one instrument. Here you have more than one externality. You have the environmental externality which is the fact that you pollute and you have also a knowledge externality because usually what you've done in the past and what people around you do have an externality on what you do today. You see, you tend to be better at doing what you used to do and or what people around you are doing. And so given that you have at least two externalities. Just using one instrument is not efficient. You could use the carbon tax alone to make sure firms redirect, but you would need a very high carbon tax and it would put a heavy weight on current generations. So it's better to have a mixture of carbon tax and the subsidy to clean innovation.

**Tim Phillips [00:06:06]:**

Yeah, because the recent French experience of a very high carbon tax that suddenly comes imposed on the public is something that the public...

**Philippe Aghion [00:06:15]:**

Exactly, and also it shows that if you just increase the carbon tax but you don't have public transportation, you don't have substitutes to gas, oil, cars, then people riot because they say, well, I have no alternative. And the big problem we have in France is that suburban transportation is not there and various people who live in suburbs or in the countryside, they have no alternative but using their cars. So you need to create alternative. And that's why you need to have this industrial policy on top of the carbon price.

**Tim Phillips [00:06:44]:**

Yeah, industrial policy is not a popular term amongst politicians at the moment. What sort of subsidies do you see...

**Philippe Aghion [00:06:50]:**

The Americans are doing it now with the IRA. I mean, I think it's important I know that the industrial policy has been denounced in the name of competition policy, that if you think that it implies picking winners, then it means that you are going against competition because you bias competition. But there is a way to do industrial policy which is pro competition. For example, the Defense Advanced Project Research Project Agency, the DARPA. The American DARPA that was created in the 50s for space and defense. And then they had the same thing for biotech with BARDA, the Biomedical Advanced Research and Development Authority. Those are ways to do industrial policy, which is pro competition because money comes from the top, but then you have team leaders that elicit competing projects. So you have a mixture of top down and

bottom up. And the bottom up part is pro competition. And so you had many labs competing for mRNA vaccines, for example. So we saw that with the COVID you had Moderna, you had Pfizer, you had Johnson, you had others, and they were competing. And so there is a way to do industrial policy, which is pro competition. The worry was legitimate that industrial policy could harm competition. But a good governance, an appropriate governance of industrial policy can in fact help deal with this problem.

**Tim Phillips [00:08:04]:**

Is it also a way to hurry up innovation? Because from what we've seen with vaccines, as you say, time is short and innovation takes time to diffuse into the economy, doesn't it?

**Philippe Aghion [00:08:15]:**

There are also ready technologies that exist, but the problem is that they are often expensive. So you need to innovate to find new source of energy or to make existing green technologies cheaper and more accessible, in particular to developing countries. And so that innovation is required there as well.

**Tim Phillips [00:08:41]:**

Is there a difference in the policy that we need in the short run and the long run? Because you're very clear about what we need to do now. Is that something that we would just do forever?

**Philippe Aghion [00:08:49]:**

You know, for example, there are things like shale gas revolution in the US. Which was, I think, a good thing to do because the shale gas revolution helped reduce CO2 emissions because you would substitute gas for coal and gas is less polluting than coal. So that helped reduce CO2 emissions. And we have, for example, in France, we have nuclear fission and nuclear plants. So we want to build more nuclear plants. That I think is a good idea in the short and medium term because it helps reduce CO2 emissions but at the same time we want to pursue more long term innovations, you see, like hydrogen cars, nuclear fusion there are other things possibly Plan B innovations, which is innovations aimed at cooling the air. I know people smile when we mention that but I think there is promise there as well and I think we should pursue that in the longer term. Of course, the whole challenge is when you go for shale gas revolution or for nuclear plants you want to make sure that that will not divert research resources away from the longer term sources of energy. You see what I mean? And so at the same time you pursue and you develop intermediate source of energy which are less polluting than coal you want to make sure that you maintain and even reinforce research efforts in the longer term strategies and so you have to have both things pursued at the same time.

**Tim Phillips [00:10:03]:**

Yeah, because it would really change the conversation about sustainability if you were to include shale gas and nuclear fission in it at the moment which are not widely supported.

**Philippe Aghion [00:10:12]:**

Exactly.

**Tim Phillips [00:10:13]:**

So when politicians talk about green innovation as the path to growth they talk about it a lot. They very often delay on putting forward these proposals because, as you say, it's about how much the economy is going to shrink in the meantime, isn't it? Are you worried that the political will is not there?

**Philippe Aghion [00:10:31]:**

My view of the energy transition is very much like the railway system. I have a colleague in France who put forward that idea so I should give him credit for that. His name is Ferghane Azihari and he established the parallel between the energy transition and the railways construction in France. It was a huge investment and it was achieved through a partnership between public and private sector. Transition in Eastern Europe was also involving a partnership between public and private. So I very much believe in that. I think Europe as a whole can borrow more but can borrow against the ETS and the carbon tax. You see what I mean? It will be a borrowing supported by the carbon tax and the proceeds of the carbon tax and the ETS. And with this borrowing, Europe could do some development banking. You see what I mean? You have some public funds that come from this borrowing and then you involve the private sector. You know the EBRD? The European Bank for Reconstruction and Development. For each Euro it puts on the table it can finance €3 projects. You see what I mean? The private sector puts €2. So I think we can because there's been studies recently, for example, my colleague Jean Pisani-Ferry in France has with a colleague of his called Selma Mahfouz tried to quantify the costs in France of the energy transition. So it's huge. But the question is how to finance it. And I think we can't avoid a partnership between public and private. But the public part would be this borrowing which would be guaranteed by the revenues from the carbon tax of the ETS and then you leverage it with private sector involvement. And so it will be a costly process because we know it's costly, we have to acknowledge it. But we can finance this cost. But the problem is the question is the opportunity cost is that doing nothing is even more costly? It's not that the choice is that if we don't do anything, things get worse. So you always have to compare. You have to reason not only in term of cost, but in term of opportunity cost. What will be the cost of not doing anything?

**Tim Phillips [00:12:26]:**

Now, the way you're framing this is a contract between public and private, between government...

**Philippe Aghion [00:12:35]:**

I would say European governance. I see that at the European scale.

**Tim Phillips [00:12:37]:**

What about the public? Where do they fit into this? Because at the moment you see people who are in favor of doing more about climate change they're resorting to protesting.

**Philippe Aghion [00:12:49]:**

Of course, because the things have to be known in a way that avoids the yellow vest movement. It's important to provide alternatives. You see what I mean? The yellow vest movement again, it was because you had people living in suburban areas or in rural areas that had no alternative to using their cars. And for years the French governments, previous French governments had told them why don't you buy a gasoil car which is less polluting than a normal regular termic car and you live in suburbs. There was major underinvestment in suburban transports. And then suddenly you said ah no, in fact, too bad, you are trapped and we will tax you the gasoil. I mean, that was unfair. You see what I mean? And that was really taking them as hostages. And that's not right. I mean, you should provide the alternative. That's why Macron proposed all the metropolises to develop a good suburban transportation system. Absent that, you will provoke, you will trigger further yellow vest movements if you increase carbon tax too much. You have to be very careful how you do it.

**Tim Phillips [00:13:49]:**

Is there any formal mechanism that we can use so that the voice of the public is heard more?

**Philippe Aghion [00:13:54]:**

No, I mean, of course the democracy. I don't know in terms of democracy, I believe very much in civil society. So there you are. Bring me there. I mentioned the role of the state. There is a role of civil society. Consumers play a big role. Consumers, they become increasingly aware of the environmental problem. They push firms to produce and innovate greener. And now we see that increasingly, I think it's important to inform the public about the CO2 content of the output and input of various productions. I think that's important so that you know whether that firm is virtuous, that firm is not virtuous, and that, we know, influences the consumption choice of a number of consumers. So that, I think, is a very effective force. It's not only the state that can redirect technical change, but also consumers can redirect change if they are properly informed. And so it's important to inform them. Then you can have associations, then you can have

various movements. But I think informing the public is very important because the public and the civil society has a big role to play into redirecting technical change towards green technologies.

**Tim Phillips [00:14:54]:**

So finally, Philippe, is there a role here for economists? A lot of the research that you have done has showed us what the policy options are. Some of them are not very palatable and some of them at the moment are not really considered seriously. How do we bring those into the debate?

**Philippe Aghion [00:15:11]:**

I think now we made progress on the idea that innovation is a big part of the solution and also the fact that industrial policy, that carbon price is not enough. You need in the smart industrial industrial policy aimed at green innovation. That's the idea. So you want an innovation policy which is pro competition and which favors green innovation. For example, if you look at the Blanchard-Tirole Report, it has the idea of the two legs. There is a carbon price leg and the other leg, before there was only the carbon price. And that idea has made progress, I think, and the importance of green innovation and through that way, I don't remember. Tirole has not been a great advocate of industrial policy. He's pro competition, and he's right. And I am also very pro competition. But I can see that with regard to the green innovation, there is now the view that smart industrial policy is unavoidable. So I can see that the public opinion is evolving. And now, especially in Europe, you are competing with China and the US on that. And the best way to compete is not to do protectionism is to innovate, but to innovate effectively. Carbon tax is not enough. You need to have European green data, quite essentially.

**Tim Phillips [00:16:14]:**

Philippe, thank you very much.

**Philippe Aghion [00:16:16]:**

Thanks so much.

**Tim Phillips [00:16:26]:**

So I'll give you three references for this one. First of all, for the patent research. There's a paper called Carbon Taxes Path Dependency and Directed Technical Change. Evidence from the Auto Industry. The authors are Aghion, Dechezleprêtre, Hémous, Martin, and Van Reenen. It was published in the Journal of Political Economy in 2016. For more insight into the role of intermediate technology, the paper is called Climate Change Directed Innovation and Energy Transition: The Long Run Consequences of the Shale Gas Revolution, and that's from 2019. The authors for that Acemoglu, Aghion, Barrage and Hémous. For consumer preferences on innovation. Then read Environmental Preferences and Technological Choices. Is Market



Competition Clean or Dirty? And the authors are Aghion, Bénabou, Martin and Roulet. And that was published in AER Insights in March 2023.

**[Voiceover] [00:17:30]:**

This has in a VoxTalks recorded at the Paris School of Economics CEPR Policy Forum, 2023. If you like what you hear, subscribe. You can find us wherever you get your podcasts and you can listen to clips of past and future episodes when you follow us on Instagram at VoxTalks Economics.