



Transcript of IMF podcast:

Michael Kremer: Investing in Vaccines Now Would Buy Time, Save \$Billions

Michael Kremer:

There's a lot of encouraging news on testing, but there's another barrier. Even after a vaccine is available, there's often a very long delay before there's enough vaccine to reach everybody who needs it.

Bruce Edwards:

Nobel Laureate Michael Kremer has been studying the economics behind vaccine production for years. These days the imperative to quickly distribute an eventual COVID-19 vaccine has him looking at ways to encourage firms to build the manufacturing capacity even before their vaccines are approved.

Michael Kremer:

This is very costly, it's very time-consuming. So they typically wait. Why take that risk and spend all that money when it might not even work.

Bruce Edwards:

Welcome to this podcast produced by the International Monetary Fund, I'm Bruce Edwards.

Bruce Edwards:

Some of the research that Michael Kremer gained some notoriety for was his work on the design of advanced market commitment models or AMCs used to incentivize the private sector to work on issues of relevance for the developing world by pledging that if they developed an appropriate vaccine, funds would be available for those countries to purchase it. The approach resulted in billions of dollars being devoted toward pneumococcal vaccines for strains common in developing countries and saving hundreds of thousands of lives.

Bruce Edwards:

Kremer's latest research focuses on how to expedite the production and distribution of the COVID-19 vaccine or vaccines immediately following successful medical trials. Michael Kremer is Professor in Economics at the University of Chicago and Director of the Development

Innovation Lab. He was invited by the Institute for Capacity Development to present his research to IMF Economists.

Bruce Edwards:

So why can't we simply use the same approach that was used for the pneumococcus vaccine given how successful that was? Why not just do the same thing for COVID-19?

Michael Kremer:

Well, I think there are some very important similarities in these cases, but there are also some important differences. So to start with the similarities, this is a case where there's a huge social need for development of a vaccine, but also for production capacity to be put in place to enable sufficient doses to be made.

Michael Kremer:

There're differences on the technological side, in that this is probably a bigger challenge, there was already a pneumococcus vaccine against the strains of the disease that were common in higher income countries and what was missing was pneumococcus vaccine against the strains that were common in lower income countries. Whereas with COVID, we're dealing with a brand new disease and we don't know which approach will work and there's a lot of possible approaches out there. Because the health and economic of the pandemic are so severe, it's worth it to society to pursue many different targets and try many different candidate vaccines.

Michael Kremer:

And it's actually worth trying to build out the production capacity before we know what the results of the testing are. The reason for that is that building a production capacity, building the factory for vaccines, it's a very difficult and complicated process. So because that takes a lot of time, if that takes six months, then if we wait till after the testing is done and then start ramping up production to larger scale, that could be a six month delay. With COVID-19 every month that the pandemic continues, we're losing lives and we're also incurring tremendous economic losses. An estimate is that it's \$500 billion every month. So with that scale of losses, it's worth investing in building the factory capacity in advance, even if there's only a relatively modest chance for any given vaccine of the probability of success.

Bruce Edwards:

So just stepping back a little bit, going back to the pneumococcus vaccine project, it was essentially based on incentives. Why do we have to come up with incentives for companies to do this research given the potential gains from finding an effective vaccine in this case, I mean markets soar at every hint of a breakthrough, aren't the potential financial gains for these companies pretty clear?

Michael Kremer:

Yeah. So I think these are very different cases in that respect. The pneumococcus vaccine there was already a vaccine which has been used in high-income countries and they needed a different vaccine to accommodate the needs of lower income countries. Whereas, a COVID vaccine will have a global market.

Michael Kremer:

So I think there is incentive to invest in the R and D. You can argue as a sufficient incentive, lots of companies have come in, but maybe we'd like to bring others in. But what our work is focused on, it's not the R and D but it's actually the production capacity. While there's certainly incentives to put in some production capacity, it's a very different thing, given how many vaccines wind up being tested and failing during testing to put in place very large scale production capacity of the type that we would need to rapidly treat the world's population, or even marginally acceptably treat the world's population within a reasonable amount of time, put in that level of capacity.

treat the world's population within a reasonable amount of time, put in that level of capacity before companies know whether the vaccine is going to get through the clinical trials. That's something that is worth it from society's point of view, but it's not worth it for an individual company.

Bruce Edwards:

Does each country need to be building its own capacity installations? Or could we think more of a way of distributing from perhaps like a node system where you have half a dozen countries that are manufacturing these vaccines and then distributing to various countries? I guess my question is how feasible is it for a country like Zimbabwe, for example, to be building manufacturing capacity and how much should they depend on countries that can actually afford to be doing that?

Michael Kremer:

If you look at the existing systems in this industry, like many industries there's a complex production process and complex supply chains that draw on many different parts of the world. So, very few vaccines are made entirely within one country. There are many things that go into a production of vaccines, things like the bioreactors where the actual bulk vaccine is made, there're adjuvants which sort of boost the effect of the vaccine. Then there's, what's called the fill and finish which has to do with getting that vaccine into syringes, for example. This is actually ... you would think glass vials to put the vaccine in is not a big deal, turns out it's very specialized glass, made in a few places. So we actually do have global supply chains and I think it would be actually very counterproductive to say, we're going to build a separate factory in each country to produce the vaccine and try to aim for complete isolation, it's just not an efficient thing to do to set up for each country, no matter how large or small to set up its own production.

Michael Kremer:

Now, of course, it might well be efficient to take what's called the bulk vaccine and then send it for fill and finish to something located in a particular region of the world and have that done locally, just because when you're starting to talk about transporting at very low temperature things packaged in individual doses, well then you need a lot of cooling material around that. So yes, maybe you would do some steps of the production on a more distributed basis but I think a lot of this it's efficient to have a fair amount of centralization and then to do this through trade.

Michael Kremer:

In fact a lot of the deals seen do cross borders. One early deal was the US buying the AstraZeneca vaccine, that's a vaccine that was developed in Oxford, in the UK. I think it's vital to maintain country's ability to do deals across borders and I wish there were more such deals. Two of the biggest players in vaccine production, but also two very large countries that will need a lot of vaccine are China and the US.

Michael Kremer:

China's pursuing what's called live attenuated vaccines. It's possible that those vaccines will succeed and that the more higher tech vaccines that the US is specialized in won't. It's also possible that we'll have the opposite outcome. This is not something where you want to put all your eggs in one basket. It would make sense for China to be placing orders with us producers to have that capacity installed so that China could be served if it turns out that the vaccines that are produced within China don't work out. By the same token, it would make sense for the US, assuming that China would put in ... there are adequate regulatory processes and the data was shared, and this might take some negotiation. But ideally if it did turn out one of the Chinese vaccines succeeded and some of the vaccines in development in the US or elsewhere don't succeed, it's in the national interest of the US to get access to that vaccine.

Michael Kremer:

One of the most basic lessons of economics is the huge potential benefits of international trade

One of the most basic lessons of economics is the huge potential benefits of international trade. While we can argue about what are the trade offs involved in trade in many sectors, clearly if China develops a functioning vaccine, we all gain immensely if the world has access to that vaccine. Conversely, if the US develops a vaccine, the world gains immensely if there's access to the US vaccine. So having the institutions in place to allow trade and to allow confidence that trade or take place is very important.

Bruce Edwards:

So getting back to this idea of providing incentives, and again the pneumococcus approach was a bit like a lottery in that the successful candidates saw huge rewards from that, this is what you're calling a pull incentive. Whereas the investment in capacity ahead of time, or during medical trials is considered more of a push incentive, could I ask you to explain this concept of pull and push incentives?

Michael Kremer:

Sure. if you think about what is our system for supporting medical research currently, we have a mix of two types of incentives. There's upfront funding for research through university laboratories, through grants from funding agencies, like the National Institutes of Health in the US or the Wellcome Trust in the UK. Then on the other hand, companies are motivated by the ability to actually sell product. If they develop a successful product and they put it on the market, they'll get paid for that.

Michael Kremer:

That combination of some push funding and some pull funding has produced tremendous advances in health technology over the years. I think we need that same combination, or we need some mixture of the two, you don't want to rely entirely on one approach or the other. So in the case of pneumococcal vaccine, there really was not as much commercial incentive to develop that because the new vaccine that was needed would cover the strains in lower income countries and that just wasn't as lucrative as those companies were used to. So some of the pull was needed.

Michael Kremer:

As you've pointed out, the COVID case is somewhat different. There, there's at least some pull because there'll be global demand for a vaccine when it's developed. But what we need is we need to find out some of the upfront costs of putting it in the factory capacity, in advance of the vaccine receiving approval. For that, it turns out that some push funding could be very useful. Because COVID is causing such huge economic costs that even just from an economic standpoint, it makes sense to pursue many different candidates. We don't know which of these candidates are going to succeed. We don't even have a consensus on what the chance of success is.

Michael Kremer:

So if you're trying to think about how much of a reward do you have to offer for successful candidates in order to get the companies to make these investments you're caught between two risks. One is the risk you pay more than you need to and the other risk is the risk that you pay too little, and you don't even get a vaccine at all. This is a situation in which it makes sense to pull in a wide variety of companies, even companies that have only a modest estimated probability of success. So I think relative to the pneumococcus case, probably a greater component of push funding is appropriate.

Bruce Edwards:

So, money. Because we're talking billions of dollars of investment here at a time when public finances are being stretched to the extreme... Can governments actually afford to do this?

Michael Kremer:

Well, let me turn it around. Can they afford not to do it? The estimates are that the world economy is losing \$500 billion every month that the pandemic continues. In that type of a situation spending a few billion dollars to make sure that if we get a vaccine approved, we can have it manufactured and delivered and get people the doses they need quickly. If you advance the development of a vaccine by even a relatively modest time with even a relatively modest probability, this is just a fantastic investment from a benefit/cost point of view.

Michael Kremer:

To give an example, the US spent \$1.2 billion for 300 million doses, \$4 a dose, of the AstraZeneca vaccine. Now we don't know whether that vaccine will succeed or not, but if there were even just a 10% chance of success, and if this just advanced the availability of a vaccine by three months, we estimate that the benefit/cost ratio would be 45. In other words, the benefits, even adjusting for the modest probability of success, would still be 45 times the cost. So if you have more optimistic assumptions, it would be an even greater benefit cost ratio. This is really a vital investment for not only for our health, but for restarting our economies.

Bruce Edwards:

So, that's like millions of dollars every hour.

Michael Kremer:

Yeah. Another way to put this as if we knew for sure that this was going to advance a vaccine by 10 hours it would be worth having made this \$1.2 billion investment.

Bruce Edwards:

Are we talking about one or two of the big advanced economies investing in this? Or do we need a global system to make this push funding model work?

Michael Kremer:

So, we've done the analysis for whole range of countries and what we find is that it even makes sense, even if they have to spend their own money, it would be worth it for low-income countries. Now the higher the income of the country, the more shots on goal they want, the more vaccine candidates they would want to purchase capacity for, and the greater the quantity of vaccine they would want. So high-income countries might spend more, but middle-income countries and even low-income countries would benefit from making these investments. Indeed, we're seeing middle-income countries, for example in Latin America, start to make these purchases. It's not just high-income countries.

Michael Kremer:

Do we need a global system? I think there are huge gains from global cooperation in this area, and that we definitely need global cooperation. Having each country think they're going to make their own vaccines is a delusion. We don't know which vaccine will succeed. We don't want to be in a position where the US only gets a vaccine if a US domestic manufacturer produces it, and same with the French, and same with Bangladesh. It's much better if countries are free to order whichever vaccines they think are most likely to succeed and whichever have attractive pricing. Then they can use that wherever it comes all over the world. That's just international trade. It does require some basic level of international cooperation, but there is also an effort to go beyond that and to have a much more coordinated international effort, so for example, through COVAX Program.

Michael Kremer:

I think there are potential advantages of that type of approach. But what remains to be seen is the extent to which high-income countries are going to choose to go with that approach as their main source of vaccine supply, as opposed to making individual deals on their own.

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Bruce Edwards:

So, so where do a developing countries fit into this model? And given their extremely limited ability to invest in anything, especially these days, do they risk getting perhaps, suboptimal vaccines or being left out entirely from the process?

Michael Kremer:

So there are international efforts for the lowest income countries, for low-income countries, for the purchases to be made by donors or the funds be provided by donors. I think that's something that I hope that we can all agree, that it would be terrible and unjust if people were dying, if vulnerable groups, if health workers, if the elderly, who desperately need access to these vaccines, can't get access just because they happen to be born in the wrong place.

Bruce Edwards:

So you touched upon this earlier, the potential for supply chain shortages, and you mentioned the glass vial as an example. We did experience shortages of just about everything for the first few weeks of the pandemic, how do we avoid supply shortages when it comes to manufacturing a vaccine for seven billion people?

Michael Kremer:

So I think a lot of progress has been made on the glass vial issue and part of the way that progress was made was by signing deals, not just with the ultimate vaccine manufacturers but with some of the critical suppliers in the supply chain. I think doing more of that is going to be very important. Part of the economic logic for why that's important is that there're strong pressures on companies to not increase their prices in this type of situation. But if you think about a company that's producing a certain component, whether that's bio-reactors or adjuvants, they have a certain factory capacity in place, they have a certain price, but now they may be dealing with an unprecedented increase in demand.

Michael Kremer:

Now, satisfying that demand is going to require building new factories for example. Might be that you're putting in a factory that could produce for the next 20 years, but we don't know how long this increase in demand is going to be for. It might be for 20 years, but it's also possible that this will be a temporary phenomenon- there'll be a few years where billions and billions of doses will be needed, but after that not so much will be needed. So as a firm that produces the inputs into production, your risk in a situation where you build a factory that's going to last for 20 years, but that factory sits idle for 18 of those 20 years. That's not a very attractive situation to persuade the people with the green eye shades that this is a good investment. If you're not going to be able to raise your prices and if you risk having your capacity sit idle.

Michael Kremer:

So how can you address that? Well, one way would be to say, fine, we'll pay more, and by paying more we're going to make this worthwhile to invest. There are a couple of problems with that approach, first, how much do you need to pay? We don't know exactly, to convince a company to invest. You're back to that dilemma, you offer too high a price, and you're wasting money, you offer too low price, you don't get the vaccine at all. So another issue is that even if the government said they'd pay more, the companies may come under a lot of public pressure.

Michael Kremer:

I think an important part of the solution may be for governments to directly offer to finance some of the cost of the factory construction. I don't want to claim that approach is perfect, but I think that might be part of the solution.

Bruce Edwards:

Bruce Edwards:

Well, we do build every four years, Olympic facilities that are used for a few months and cost billions of dollars.

Bruce Edwards:

So, you spent your morning talking to IMF economists, all working hard to find solutions to the economic pressures from this pandemic. Where do you see the IMF, and the other international financial institutions, fitting into this scenario you're proposing, for countries to invest at risk into vaccine manufacturing capacity before a vaccine is found to be effective?

Michael Kremer:

Well, that's a great question. It started out with high high-income countries then it moved on to middle-income countries, but I think more and more countries are deciding that they want to make this investment. Now, this is a time when countries are under a lot of financial pressure, as you pointed out, and they may need financing for that. The World Bank made a very important decision to make up to \$12 billion available for countries to take out loans to purchase vaccines. I think there's substantial interest in other multilateral development banks in doing something similar. Our calculation suggests that investments considerably in excess of that would be needed. So I think it will require more than one multilateral development bank to do this.

Michael Kremer:

What's the role of the IMF? Well, the IMF is lending to countries to help them deal with the consequences of the epidemic. Historically sometimes the IMF has said, "well, we'll lend to you, but we want to see your cutbacks on domestic spending." My understanding is that right now they're really prioritizing getting resources to the countries that need it. But certainly, if the IMF is trying to think about advice on expenditure by countries, this particular type of expenditure seems like something that's very warranted and not just from a health point of view, but even from a purely economic point of view. These investments are high enough pay off that they're worth making.

Bruce Edwards:

Professor and Nobel Laureate, Michael Kremer, thanks so much for taking the time.

Michael Kremer:

Great. Thank you so much.

Bruce Edwards:

Michael Kremer is professor in economics at the University of Chicago and Director of the Development Innovation Lab. He shared the Nobel Memorial prize in economics in 2019 for his work on experimental approaches to alleviating global poverty. Kremer spoke to economists at the IMF's Institute for Capacity Development. Go to [IMF.org](https://imf.org) to find out more about the work of the Institute for Capacity Development and possible training opportunities.

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