

O-Ring Production Network Podcast Transcript

Banu Demir Pakel

Welcome, to the CSAE Research Podcasts, a series of conversations about research taking place at the Centre for the Study of African Economies at the University of Oxford. I'm Banu Demir Pakel, an associate professor of economics in the Department of Economics at Oxford and a member of the CSAE.

Today we'll be discussing the paper 'O-Ring Production Networks', which was published in the Journal of Political Economy earlier this year. I'm very pleased to be joined by my coauthors, Cecilia Fieler from Yale University, Daniel Yi Xu from Duke University, and Kelly Yang from Indiana University.

Before starting the conversation, let me do a spoiler alert and get to the research question we ask in the paper. So here we dive into a long standing question, which is what is the role of international trade in economic development, particularly in lower income countries? Cecilia, could you explain the motivation behind this research question as well as the mechanism highlighted in the paper?

Ana Cecilia Fieler

Yes. And, my pleasure. It's a pleasure to be here. You just mentioned a really broad question that motivates us. The vast majority of countries implement some form of export promotion, but what we observe is a vastly heterogeneous outcomes. So for some countries, it really doesn't seem to have much of an effect. Whereas in East Asia, if you look at the development over the years, it really seems to have catalysed broad changes in manufacturing. So, manufacturing great, think about the East Asian Tigers, South Korea, Taiwan and then China more recently, manufacturing grew it improved into producing more sophisticated, higher quality products. Its workforce similarly became more skilled. And that had a very broad effect on the domestic market. And what's puzzling about it is that even in these countries, but in virtually all countries that researchers have looked at, exporters are a relatively small share of manufacturing firms and more tradable sectors. So, for example, in Turkey, where we'll look at the data, exporters account for 20% of manufacturing firms. But our mechanism that's going to go through production networks, these firms are extremely large players they account in at least one side of the trade and manufacturing inputs in 78% of the transactions. And if you weigh these transactions by value the exporters are in one side of 91% of trade in inputs. And so our mechanism is precisely that the positive effects that exports have, and exports to rich countries in particular have on these exporting firms, are passed through the production chain.

So, to understand the mechanism better, let's take the specific example of an auto parts producer that sells both to Germany, say, Mercedes, a very high quality firm, and to, Russian Lada. If it experiences a demand that higher demand from Germany, from Mercedes, then it's likely to

undergo several changes. For example, Germany tends to demand the higher quality products for which the firm may want to implement more modern machines that produce with higher precision and higher quality. These machines also tend to produce in small batches, making the firm more amenable to adapting to supply and demand shocks. Another demand aspect of the demand from a high quality Mercedes firm, so the firm is also likely to adopt the just in time inventories. It now needs to show up at the right time and deliver the right good with the right specifications, and be able to change those specifications on the call, which typically calls for better improvement in communications and broad improvements in management. All these changes, they require more skilled workers. So, what you observe in what I've described, is that when a firm experiences a higher demand from a rich country, Mercedes in our example, then it's likely to experience very broad improvements in management, technologies and logistics management. And the same is true if let's say it experiences an increase in demand from Lada, but as the firm improves through the same mechanism, it's also going to demand from its suppliers that they deliver higher quality, that they deliver that flexibility to adapt to demand and supply shocks. So the firm, in a sense, passes through that shock. The shock propagates to the domestic market.

To summarise the positive effects of trading with a rich country that exporting firms experience, may potentially propagate to the domestic market through production chains. In the question that we are after, when does it occur? When does the exporting propagate to create these broad effects on the market? So why don't I turn to Banu now and she can tell us how we look at the data to see if the micro foundations of that element of demand for skill improvements at the firm level show up in the data.

Banu Demir Pakel

Sure. So the examples you gave are amazing, but unfortunately we can't just pick a few examples from business case studies or so on. So our challenge when we started this project was to come up with a more structured way of looking at the data to be able to identify these challenges.

And so to provide empirical evidence for the motivation, Cecilia explained just now, we relied on some fascinating micro-level data from Turkey. So the data includes a wide range of information about Turkish firms, from their domestic firm to firm trade transactions and international trade transactions to balance sheets, income statements and even details on their workers' wages and occupations, which happens to be an important piece of information for our purposes.

So using this rich micro-level administrative data set. One interesting pattern we observed was what is known as positive assortative matching on wages. What does it mean? It simply means that high wage firms tend to trade more intensively with other high wage firms in the data. And as you might expect, this leads to a clustering of firms that pay higher wages. In the paper we use average firm level wages as a, as an indicator of their output quality. And the existing literature further tells us that high income countries tend to demand higher quality products. Building on this idea, as well as the positive assortative and matching on wages that we observe in the data, we show that when demand for a firm's exports increases from wealthier countries, there's a positive effect, on its average wages. And interestingly, not only do the exporting firm's average wage rise, but so does the average wages of its buyers and suppliers in the domestic market. This empirical pattern simply sheds light on how international trade, and exporting to richer countries in particular, can create

this ripple effect that benefits business partners of exporting firms domestically in developing countries.

And maybe this is a good time for Kelly to explain to us the empirical findings in more detail and how they relate to our theoretical predictions that lead us to counterfactual exercises we do in the paper.

Kelly Kaili Yang

Sure, happy to. So Banu just gave a great discussion of our empirical results. Let me begin with quickly highlighting two of our empirical facts that we documented. So the first empirical fact, is the positive assorted matching of skills in the production network. So here we use wage as a proxy for skill intensity. What we find is that high wage firms, they disproportionately trade more with other high wage firms. In both the extensive margin where they match more or trade more with each other, and also the intensive margin where, given the matches, they also spend more on each other. So these two margins are both important in explaining the sorting patterns we document in the data. For the second empirical results we moved from cross-sectional to over-time variation or pattern. Here we use a shift-share regression design to look at firms' responses to increase in the demand of their exports, and particularly the increase coming from rich countries. So what we find is that this kind of quality based demand shock not only increases firms' own wages, but also the wages of their suppliers and customers. And part of that increase, is driven by firms hiring new workers and also forming new business connections that have higher wages, compared to before.

So motivated by these empirical findings, we then develop a quantitative model of heterogeneous firms. So Cecilia has done a wonderful illustration of the main mechanisms in our model in the beginning. So here I'll just briefly summarise two key ingredients of our model and then talk about the implications, from our estimation.

So first of all, in our model, each manufacturing firm are going to endogenously choose its own quality. So this quality choice is not only going to determine the quality of its own output, but more importantly, it could also affect the marginal product of high quality inputs. Or in other words, we're going to allow the productivity, where the value of quality inputs is high, to also depend on the purchasing firms on quality or output quality. So this is the complementarity in production in our model. And that's going to govern the intensive margin of assorted matching we saw earlier.

And the second ingredient is that each manufacturer in our model can also endogenously choose their suppliers and customers, in a search and matching framework. So here we can think of firms they need to post advertisements, exert search efforts to find trading partners. So how these search efforts are distributed among buyers and sellers of different quality levels are going to affect the second complementarity in our model complementarity matching. And that's going to cover, the extensive margin of sort of matching. So, our model in general is able to match the important data moments fairly well, including the two empirical facts we just talked about, assorted matching in wages, and also the shift-share response to export demand shocks. We are also able to match the joint distribution of firm wages, sizes, number of suppliers and customers, etc. very well.

So now let me talk about the important implications from our estimated model. So the first one, what we find is that the firm's search effort is directed more towards trading partners in similar quality segments to their own. We do see the complementarity and matching. The other more interesting one is that our parameter estimates suggest that there's strong complementarity between input quality and output quality in production. So this feature of quality complementarity in input and output will make the quality choices of firms all interrelated. And this interconnection in firms quality choices will be very important in understanding some of the interesting results we find in the counterfactual analyses. So now I'll pass along to Daniel to tell us more there.

Daniel Yi Xu

All right, thanks a lot, Kelly, for really setting this great stage for me and emphasising this interconnectedness of the firms' upgrading decisions. So, now I'm going to use this as an opportunity to circle back to the initial question that was posed by Cecilia. We're thinking about these promotion policies being so prevalent across different countries and why we see a big response in some of the countries, while we don't see that in some of the other countries. Before I go there, let me first emphasise that to have an equivalent model in terms thinking about the interconnected firms, is going to be a crucial ingredient to understand the answer to these questions. So, general equilibrium is very important here because while our empirical identification relies very heavily on this idea that firms are going to respond differently to idiosyncratic export demand shocks. Our model is going to be thinking about a hypothetical scenario that there are a broad range of firms who are all going to be experiencing a certain type of export demand shock, very likely coming from the government's export promotion efforts. So within this equilibrium, we're going to maintain the magnitude of these export promotion demand shocks, they'll be very comparable to those idiosyncratic shocks we have seen currently in the data, just to make the scenario more realistic. Imagine the government would actually try to subsidise the matching effort by running trade fairs and or by helping them to match up with foreign business partners, by subsidising this effort by around 9%. And that will be generating a common export demand shock of around 5%. Very similar to what we have seen in the idiosyncratic demand experienced in our empirical setting.

What's going to happen to the overall economy in that scenario? Our model predicts that there'll be a broad range of changes, starting with the exporters themselves, and not surprisingly, because they are now being matched to more customers, particularly from high income economies, they will have more motivation to increase their own quality. And hiring more skilled workers. But the reaction doesn't really stop there. The two pieces of the model forces that Kelly emphasised will enter here. The first thing is that these firms are now going to increasingly use more high quality inputs, right, coming from the domestic suppliers. And then that in turn, is going to promote the adoption of high quality decisions by the domestic suppliers too and the domestic supply is going to respond to that. And the second force is that they are going to be increasingly targeting their search towards the segment of the domestic economy, which is able to provide high quality inputs too. And then meanwhile, the domestic supplier realising that's happening, they will also adjust their efforts accordingly. So that's going to trigger a very broad range of changes in the domestic manufacturing economy. So our model can then predict that because of those forces together, as a whole, there'll be a lot of upgrading happening, not only limited to these exporters, but also happening to the domestic firms. And as a whole, we'll see a pretty significant increase of the

domestic worker wages by around like 1.2%. And thinking about the magnitude, this will be almost like 8 to 9 times larger, compared with another, more standard model where we still have domestic import connections, but we don't have these kind of endogenous search effort embedded in there. Neither do we have that sort of matching of the quality of the input output channels in there, then the reaction will be much more muted compared to what our model will be illustrating.

Then you think, okay, that's such a rosy picture right. That that sounds like an East Asian economy, that Cecilia has just mentioned. But why doesn't it happen everywhere? And then for the rest of the paper we're putting a lot of tariffs to argue that a lot of the domestic conditions could affect the strength of that response. For one thing, you can think about this broad scale of challenges will need more skilled workers. Right? So depending on the education level and the initial condition of the local labour market, in those countries, and the supply elasticity of the skilled labour, is going to determine the strength of this channel by a lot. So if you think about, when Cecilia initially mentions thinking about East Asian economy, a lot of them have a rich stock of human capital already embedded in these economies. And, because of the abundance of the supply of the skilled workers, which already exists those economies, they just allow them to facilitate these kind of changes a lot easier. While when you look at some other countries, maybe their conditions just don't hold.

Another thing we tend to observe in some of the East Asian economies is that, very often, they were running a trade surplus for an extended amount of time. The government would be thinking about exchange rate policies that allow these acts to expansion to run for an extended period of time. While when we think about some other economies, maybe the trade rebalancing is happening really quickly. And then the exchange rate appreciation is going to really put a brake on a lot of the export expansion experienced by these firms and then back down on a lot of the initial changes that we tend to see. So, in general, for the rest of the paper, we really highlighted that to achieve this broad level of technological upgrading that our model has generated, there are a lot of additional necessary conditions. Some of them are holding for some countries, but some of them might not. So to assess the success of the policy and to design the policy, really we need to think about the whole package, and not the export promotion policy by itself in isolation. So I think I will close the general prediction based on our paper here. And get this back to Banu.

Banu Demir Pakel

So there's some initial conditions as well as other policies that need to complement these types of export promotion policies in order for these countries to benefit, as predicted by our model. But do you think it's only, export promotion policies or can our results also provide some insights into other type of policies that are being discussed in policy circles right now?

Daniel Yi Xu

Yeah. I think the our paper actually provides more generalisable insights, because when we think about, at a deep level, what the export promotion policy has been doing in our paper is really to think about something like correlation device. Thinking about something that's going to facilitate upgrading by the firms, embedded in our production network and one is going to affect the other.

Right. And that actually has a strong flavour, to think about any other policy that generally know what we consider industrial policy, right? Any other policy that relies on these kind of big push type of ideas. And, try to think about the linkages within the domestic economy, they all have these similar features.

One example is to think about the green transition of firms. So, maybe some kinds of firms have to rely on cleaner inputs to actually achieve that. And then that makes all the firms' decisions to invest in green technology all connected to each other. But meanwhile, we can also think about how there are certain constraints on these kind of responses because the provision of those clean energies. The price might respond very strongly coming from the supply side too, so to some extent, a lot of the forces we have emphasised in our current model could be brought to other policy proposals we've been considering, in the current age, in particular when we see a revival of the discussion about the industrial policies and thinking about green industrial policies, I think a lot of things we have emphasized here could also be shedding light on the design of those kind of new industrial policies.

Banu Demir Pakel

Yeah. Totally agree.

Ana Cecilia Fielor

Yeah. I'm glad that Daniel mentioned these things, because one thing that comes out very clearly in our model is that if exports to rich countries are what's going to act as a catalyst to these broader improvements in manufacturing, then running export surpluses with rich countries works. But we can't prescribed that as a future policy. For one, rich countries are closing themselves more and more. And in addition, not all countries can simultaneously run these large surpluses with rich countries. But the broader point is that having positive effects on a few large players in the domestic market is likely to propagate through production chains and have a much wider effect on the market than the narrow measured of effect on that firm itself.

Banu Demir Pakel

Exactly. And when it comes to green transition, firms' green transition. People are talking about this tipping point, right. So as more and more firms do it it's going to lower the cost. And that's exactly one of the one of the mechanisms that we show, that we show in the paper. So upgrading to higher quality production, the cost of doing so will get smaller as more and more firms actually do it. And that is speaking very much to this tipping point discussion in green transition.

Okay. So thank you Cecilia, Daniel and Kelly for this interesting discussion. And it was amazing to revisit our joint research journey with you. And thanks to everyone for listening to this CSAR Research Podcasts, we hope you will join us again next time.

And if you want to listen to more episodes from the series, please go to the CSAE website.

Ana Cecilia Fieler

Thank you.

Daniel Yi Xu

Thank you.

Kelly Kaili Yang

Thank you.

Banu Demir Pakel

Thank you.