



Transcript of podcast with David Donaldson: “Sherlock of Trade”

June 8, 2018

Hello, I’m Bruce Edwards, and welcome to this podcast produced by the International Monetary Fund. In this program: MIT’s Dave Donaldson talks about the economic impact of India’s 19th century railroads.

MR. DONALDSON [soundbite]: *It started with an interest in just something that made it easier for people to trade with each other, and the railroads was a good example of that.*

MR. EDWARDS: Trading gold for salt is clearly a thing of the past, but studying the market for salt in 19th century India and the effects on trade of building a railroad led economist Dave Donaldson to important new findings that are relevant today.

Donaldson’s work on trade won him the 2017 John Bates Clark Medal, awarded for the most significant contributions by an economist under the age of 40. Donaldson is [profiled](#) in the June 2018 edition of *Finance and Development* magazine, and I began our conversation by asking him, why the interest in India?

MR. DONALDSON: I was attracted to India partly because it’s a fascinating place that I’d read a bit about, and partly because my advisors did all their work on India and that enthusiasm was infectious. But finally, I identified that India, up until only about a year ago, was a rare example of a country that actually taxes trade within the country. So, when trade crosses state borders in India—this changed about a year ago—but 10 years ago, when I worked on this, and 50 years ago when these taxes started, when goods crossed state borders they incurred a tariff of 15, or 10, or whatever percent tariff. That’s the kind of thing that doesn’t happen at all in most countries—the US [for example] is constitutionally prohibited.

So, I was interested in those taxes and I went to India on a factfinding mission to get the paper trail on those taxes—how big are they, where are they, did they change over time, how could we study about this, is there any data. And it was funny; I had talked to a lot of Indian economists and they all said: yes, this intranational trade prohibition in modern day India is interesting, but the thing that really united India, the thing that really changed intranational trade in India was the railroads of course, 130/150 years ago. And my first instinct was, well, what I’m really interested in is India today, not India 100 years ago.

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But, the idea grew on me and I started to think that the big historical change might be something we could learn a lot from and it would also have the benefit that it's not just a change in trade cost, it was also the return on a huge public infrastructure investment, which is something else that economists need to know more about. Making it easier for people to move and for goods to move around a country doesn't come for free; there's an open question of is that spending worth it. So, that was something else I thought I could look at with that historical episode.

MR. EDWARDS: So, one of the things about your work is that you never stray too far from the question of how it affects welfare. That study: what was the takeaway there in terms of the railroad—did it in fact, and does it, increase the welfare of the people who are using the system?

MR. DONALDSON: Yes. Not all problems we work on should be mapped back to that, but one of the attractions for me of economics as an endeavor is an attempt to do something quite profound, which is to use how people make choices—to kind of backward-infer from the choices that people make in response to different options, in a sense, different menus; that is, present people with different menus, see the choices they make and then from that backward-engineer how much better off they would be under menu A or menu B. You might think: okay, what does this have to do with the railroads?

Well, a lot of these things that I worked on like railroads have that kind of flavor. We could choose to trade with each other under the inferior, old fashioned pre-railroad technology, but now I offer you a new option, which is this railroad option. You still have the old option presumably—people could still use boats and bullock carts or walk and carry things—but now I've given you another option. So, it would be a little bit surprising if this were to be bad. But, in the real world, probably the most serious way in which this could be bad is more that it's bad for *some* people—it might be good on average for most people or for the dollar-weighted average person, but it might be bad for some people. That's a very realistic scenario.

The famous example from the US case that scholars of railroads talked about was how these new railroad towns, like Chicago, thrived, but part of the way they thrived was because they were now enjoying some of the economic activity that used to take place at river towns. And so, those former river trading hubs now would suffer and a railroad town would thrive. And the aggregate better off statement would be that the guy thriving is thriving by more than the guy who is suffering is suffering, but that doesn't mean that there is not displacement, or losers from a change as well as winners.

But, all that said, in my work on Indian railroads I didn't choose to focus much on that heterogeneity. I was interested in statistical estimation procedure that was aimed at trying to estimate the average effect on the average locality. And that number turned out to be about 16 percent of the GDP approximately for welfare that they get from agricultural goods, which was about two-thirds of consumption. So, consider it maybe 16 percent of two-thirds.

MR. EDWARDS: In the study you chose to look at the production of salt in India, and I think that's interesting. Why did you choose salt? There were a lot of things being produced at the time, so why was salt a good thing to look at?

MR. DONALDSON: Well, I owe this to a professor at the LSE where I studied. We had a weekly tea session that he generously attended to have impromptu conversations with people like me, a student at the time. And I told him I was working on Indian history, and he asked: have you read this book called *The Great Hedge of India*? I said, no, I never even heard of this. And he said: oh, well, you must read it, you must find a way to get "the hedge" into your paper. It is a wonderful book! It's written by a British librarian who stumbled upon these historical documents, as part of his job, about British India that were to do with this so-called salt hedge. And he said: this is just preposterous; this can't be a thing. So, the book is about what the salt hedge was and his lifelong journey to go to India and try to find any trace of this great hedge.

But, basically what happened was, the British were interested in taxing India, and they knew that one of the smartest things to tax if you're interested in generating revenue is a commodity that is demanded in very fixed amounts. So, think of it as, no matter what the price, we're going to still buy a lot. That means you can jack the tax way up and people will still buy a lot.

So, they of course realized that salt is doubly beneficial because in the north it can only be produced in a small number of inland locations. On the coast you can always turn salt water into salt with some panning technologies, but in the heart of the country you need a mine or you need a big salt lake, and there were only a few of those things. So, they said: okay, this is what we should do, we should charge a tax at the mine. This way, as soon as the good leaves the mine we slap a tax on it. And the tax was sometimes 200 percent. It was an incredible tax and an incredible source of revenue. And, of course, this is one of the sources of Gandhi's and the Congress's protest movement—this salt tax.

But, they quickly realized that the most profitable thing to do was to build a big wall, or hedge, right across the middle of India separating the south from the north so that everybody to the north of the line would have to pay the tax on the northern stuff. And every time the salt crossed the hedge then you would have to pay the price to cross the hedge. So, it was a customs wall, built for the purpose of effectively collecting salt taxes for most of the period.

So, I read about all this history and found it fascinating, but quickly realized that salt had a completely auxiliary benefit for me, that it had nothing to do with a lot of this history, apart from the fact that because of that history they collected a lot of data about salt—there were entire reports every month called "The Salt Report."

But for me, this meant that there was data, but it also meant one very important thing, which was that the kind of good you would expect to see a big effect on is salt, because if it can only be produced in one location yet you know that it gets to some other location—that

is, it's produced at A, it gets to B, and even though it costs a lot in B, thanks to that high pre-railroad trading technology of boats and bullocks, you will still see the good for sale in B because salt is the kind of thing everybody needs; it's a necessity.

So, you see this price gap between A where it's made and B where it's consumed—before the railroads—and you also see this price gap between A and B after the railroads get built. And that reduction in prices at B, at this destination location, under some idealized assumptions, reveals exactly how much railroads reduced the cost of shipping. So, for goods like salt, where we know the origin; that is, any time we see the good for sale at a destination, and we know the origin it came from, these are very advantageous for studying trade. That's why I ended up focusing on salt for that first step that I described earlier, which is how much did railroads actually reduce the cost of trading.

MR. EDWARDS: That's really interesting. How does that work in our digital economy? This economic concept of having a product produced in location A and then shipped or transported to location B where it's sold at a higher price—how does that work in the digital economy?

MR. DONALDSON: The theory of why you'd expect that to hold is: yes, it requires some cost of moving the goods from A to B, but it also requires that there is some competition, or at a limit, lots of competition; perfect competition. The reason that's true is: imagine just for a second that you're a company like Apple that produces your thing and you make it in China and you sell it in lots of destinations around the world. What's to prevent you from selling it for \$100 here and \$200 there? Maybe there's a cost-based reason. Just because the *production cost* in China is the same no matter whether we sell it in China or America, you might say the *retail cost* is different. That's a very plausible story for such price differences.

But, there's another plausible story, which is just that they might face consumers in that one destination market who have a lower willingness to pay for their thing, than people in some other destination market. And that's often called "market segmentation." You'd like to find the high valuation consumers—the ones who will pay anything for your product—and charge them a lot; and you find the low valuation consumers and charge them a little. And, as long as that little is still higher than your cost of production, you do that.

So, in the real world, market segmentation is very hard to do because, within a country, you can't prevent the high valuation consumers from pretending to be low valuation consumers. One of the reasons airlines offer business class tickets and economy class tickets, and now even premium economy class tickets, is to try to force people to choose which type of consumer they are. And then you offer them a menu.

But, internationally, this same thing might come up, but, of course, it's very hard for American consumers to pretend to be Chinese consumers without actually going to China and buying the iPad there, or paying a firm to do the same thing for them. So, that kind of international market segmentation is much easier for firms to do it, and that's why we see, especially for these high value goods, prices being so different across countries.

However, that's an example where the good is a monopolized good. But for a commoditized good, like salt, you could try to sell it way above marginal cost in a market with high valuation consumers, but, unfortunately, your competition will start to undercut you. You're not a monopolist on salt, it's a commoditized thing. And we have reason to believe that competition process would probably drive the price down, maybe eventually to something like the cost of production plus maybe some normal amount of profit.

And, in that world then, you would get that implication that I said earlier, where a place that you and all the competition agree is cheaper to get to, like destination 1, the price of the good would be cheaper there than in some other destination that we all agree is harder to get to.

So, yes, when I think about digital goods, I think of things that are often not commoditized. They have with them something like monopoly rights, or property rights. Think of music files, or a copy of Microsoft Windows. It's exactly the same thing—the arrangement of electrons on a website somewhere that you download no matter from where you download it. But, these firms find reasonable ways to segment markets. And so, absolutely we expect the prices to differ dramatically around the world for demand-based reasons, that is, differences in willingness to pay, or valuations, and nothing to do with cost-based differences, and the cost-based differences are zero.

MR. EDWARDS: I am struck by economics being a social science. There are so many variables and there are so many things that are not clear; unknown parameters. And you, with a degree in physics, which is a hard science—does the physicist in you come up against the economist sometimes when you're trying to figure these things out? Do you have problems reconciling the variability of the science and economics, given your background in the hard science?

MR. DONALDSON: Yes, I do. I did an undergraduate degree in physics, and that can often mean you get a very rosy view of the way that field embraces the world. You don't get told about all the dead ends that people tried and that failed, and all the theories that looked right for 40 years and then got rejected and they're relegated to the dust bins of history.

The thing about a hard science, a nonsocial science, if you like, a physical science, is that it's not always, but often, easy to isolate components of the system and become extremely confident of your analysis of that component. I read an article recently about some big puzzle in a branch of quantum physics about some property of the proton that I can't even recall, but it's basically a dispute that involves the 14th decimal place about some measurement of this proton and how 20 years ago they thought that the 14th decimal place was not very accurately measured.

So, the fact that the measurement wasn't lining up with theory is just a bit of bad luck in the apparatus, but then 20 years of apparatus improvements and increased repetition of this have now led them to think: okay, actually we have a problem here; the theory is not lining up.

But, think about that. They're taking a single proton that's an astoundingly microscopic component of reality, yet they're able to find ways to isolate it and figure out how it works down to the 14th decimal place. I think we as economists don't have that, the equivalent of that microstructure that we can understand well and then just aggregate up.

So, that gives an example of how social sciences are a little awkward because we neither have that micro unit that we think is stable and behaves in a certain way, and follows a bunch of laws, always and everywhere, that we could ever hope to figure out. You might think the micro unit is a human being, but obviously human beings don't follow laws of behavior always and everywhere. So, it would be foolish to say you could hope to figure that out. But, equally, the macro units that matter to us, whether they're the market for salt in a corner of India, or the market for T-bills right now, or the market for loans on Wall Street—these things are not at that blissful macro level where all the things we don't understand always perfectly cancel out. That's the physics example of when they work on the big macro stuff, like the example I gave earlier. Unfortunately, we're stuck in the middle—the things we want to know don't have the super-felicitous properties of aggregation.

MR. EDWARDS: So, do you see the field of economics changing dramatically with the digital economy?

MR. DONALDSON: The biggest change by far in economics, I think, in the last 10-20 years has to be the arrival of data. Not just the arrival, but the massive flood of availability of data that we have. An example I always like to use is: when I started my work on India as a grad student 15 years ago I was excited, over the moon, about the fact that this was an extremely rare scenario where we could observe trade of goods within a country. It happened to be 130 years ago in India; it happened to be extremely fortuitous for me that was true because I could look at that second step that I referred to earlier about how the railroad has changed, how much and what was traded. But, the fact that the data existed was a kind of miracle. Such data doesn't get collected for most countries even today—the US [for example] does a small survey every five years on intranational commodity flows.

Recently, I started a project about this high-speed rail stuff in China where we have access to all the credit card transactions in China. The main credit card clearinghouse is willing to work with researchers and say: yes, you can tap into our servers and access that bank that has terabytes of data and you can ask it questions that are anonymized, but you can't map the credit card identifiers to anything else.

Of course, it's not ideal data; it wasn't collected for the purpose of studying trade, unlike the British thing or the US commodity flow survey, but it gives us a pretty unique window on [a scenario]: there's a credit card ID here that on this date and time bought \$112 worth of stuff from this merchant ID over here. So, that is trade data at some level.

I've also been looking at tax data, where within countries, thanks to the way they collect taxes you see where every time a transaction is made a tax is charged, and that transaction gets registered in the government's own administrative data banks. And so, the fact that the

data is digitized and archived and that there are partners that are willing to share anonymized versions of it is a total game changer.

Ten or 15 years ago, like I said before, most datasets that economists used would have been official data sources, like a census or a survey of firms or a monthly survey of American workers and their wages and their employment trajectories, etc. Nowadays, the data environment has completely changed.

MR. EDWARDS: That was Dave Donaldson, Professor of Economics at the Massachusetts Institution of Technology, and 2017 John Bates Clark Medalist. A profile of Donaldson, entitled “Sherlock of Trade” is featured in the [June 2018 edition](#) of *Finance and Development* magazine. The magazine is available on line at IMF.org/fandd, or you can download the *Finance and Development* app to read on your mobile device.

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