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How physics can explain why some countries are rich and others are poor.

By Tim Harford

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If economics can tell us something useful about crime, marriage, or carpooling—as I believe it can—then other academic disciplines should have something to tell us about economies. Last month, *Science* published an example that may turn out to be important. Two physicists, Cesar Hidalgo and Albert-László Barabási, and two economists, Bailey Klinger and Ricardo Hausmann, have been drawing unusual pictures of economic "space" that promise a deeper understanding of the biggest question in economics: why poor countries are poor.

There are many explanations, but some are easier to test than others. One very plausible account of why at least some poor countries are poor is that there is no smooth progression from where they are to where they would be when rich. For instance, to move from drilling oil to making silicon chips might require simultaneous investments in education, transport infrastructure, electricity, and many other things. The gap may be too far for private enterprise to bridge without some sort of coordinating effort from government—a "big push."

That is an old and intuitive idea in economics, but as an informal argument it leaves a lot to be desired. For a start, while plausible, it might not be true. If it is true, it might be far more so for some kinds of economy than for others. And if there is to be a big push, in which direction should it go?

Testing the idea took three steps. First, economists at the National Bureau of Economic Research broke down each country's exports into 775 distinct products. Next, Hausmann and Klinger used that data to measure how similar each product is to each other product. If every major apple exporter also exports pears, and every major pear exporter also exports apples, then the data are demonstrating apples and pears to be similar.

Presumably, both economies would have fertile soil, agronomists, refrigerated packing plants, and ports. For the third step, Hausmann and Klinger called upon Hidalgo and Barabási, who specialize in mapping and analyzing networks. The result was a map of the relationships between different products in an abstract economic space. (And look at more maps here. Apples and pears are close together; oil production is a long way away from anything else.

"The physicists' map shows each economy in this network of products, by highlighting the products each country exported. Over time, economies move across the product map as their export mix changes. Rich countries have larger, more diversified economies, and so produce lots of products—especially products close to the densely connected heart of the network. East Asian economies look very different, with a big cluster around textiles and another around electronics manufacturing, and—contrary to the hype—not much activity in the products produced by rich countries. African countries tend to produce a
few products with no great similarity to any others."

That could be a big problem. The network maps show that economies tend to develop through closely related products. A country such as Colombia makes products that are well connected on the network, and so there are plenty of opportunities for private firms to move in to, provided other parts of the business climate allow it. But many of South Africa's current exports—diamonds, for example—are not very similar to anything.

If the country is to develop new products, it will mean making a big leap. The data show that such leaps are unusual.

None of this is proof that other development prescriptions—provide financing, fight corruption, cut red tape, and lower trade barriers—are useless. Nor is it a green light for ham-fisted industrial policy. Klinger warns: "It's easy to take the policy implication too far and start trying to pick and choose where to settle in the product space." But it is a big step forward. Policy-makers should take note, and economists, too.

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